Instruction Manual
Axpert-Eazy Series

400V System, 22kW (30Hp) ~ 1550kW (2075Hp)
500V System, 30kW (40Hp) ~ 1400kW (1875Hp)
600V System, 30kW (40Hp) ~ 1800kW (2415Hp)

NOTICE

1. Read this manual thoroughly before using the Axpert-Eazy, and store in a safe place for reference.
2. Make sure that this manual is delivered to the final user.

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PREFACE

THANK YOU for purchasing the “Amtech ***Axpert-Eazy*** Series AC Variable Frequency Drive”.

Axpert-Eazy Series AC Variable Frequency Drive is a modern Digital Signal Processor based highly functional AC DRIVE that is easy to use. It employs latest generation IGBT as a switching device and pwm control technique to apply commanded output to the motor to control the motor speed.

PLEASE READ THIS MANUAL THOROUGHLY before use, and keep the manual at hand for later reference. Also make sure that this manual is delivered to the final users.

The purpose of this Instruction Manual is to provide basic information on Installation, Start-up, Operational and Troubleshooting for the ***Axpert-Eazy*** Series AC Variable Frequency Drive.

WARNING

ALWAYS READ THIS MANUAL THOROUGHLY BEFORE USING THE AC DRIVE.

THIS AC DRIVE CONTAINS HIGH VOLTAGE CIRCUITS THAT MAY BE FATAL TO HUMANS. USE EXTREME CAUTION DURING INSTALLATION. MAINTENANCE MUST BE PERFORMED BY QUALIFIED TECHNICIANS, AND ALL POWER SOURCES MUST BE DISCONNECTED BEFORE ANY MAINTENANCE. SUFFICIENT NOTICE MUST BE GIVEN TO THE GENERAL OPERATORS AND WORKERS BEFORE STARTING.

• ***ELECTRIC SHOCK MAY OCCUR IF THE FOLLOWING POINTS ARE NOT OBSERVED***.

(1) DO NOT OPEN THE FRONT COVER WHILE THE POWER IS ON.

(2) A CHARGE STILL REMAINS IN THE AC DRIVE WHILE THE INDICATOR IS LIT EVEN IF THE POWER HAS BEEN TURNED OFF. DO NOT OPEN THE FRONT COVER IN THIS CASE. WAIT AT LEAST 20 MINUTES AFTER THE INDICATOR GOES OUT.

(3) DO NOT CONTACT THE ELECTRICAL CIRCUIT WHILE THE "CHARGE" LED ON THE UNIT IS LIT. PERFORM SERVICING, ETC., AFTER WAITING AT LEAST 20 MINUTES AFTER THE LAMP GOES OUT.

(4) ALWAYS GROUND THE AC DRIVE CASE. THE GROUNDING METHOD MUST COMPLY WITH THE LAWS OF THE COUNTRY WHERE THE AC DRIVE IS BEING INSTALLED.

• ***THE AC DRIVE MAY BE DESTROYED BEYOND REPAIR IF THE FOLLOWING POINTS ARE NOT OBSERVED.***

(1) OPERATION WITHIN THE AC DRIVE SPECIFICATIONS.

(2) PROPER CABLE CONNECTIONS TO INPUT/OUTPUT TERMINALS.

(3) CLEANING AND ENOUGH VENTILATION TO THE AC DRIVE INTAKE/OUTTAKE PORTS.

(4) OBSERVATION OF CAUTIONS LISTED IN THIS INSTRUCTION MANUAL.

• THERE MAY BE SOURCES OF NOISE AROUND THIS AC DRIVE AND MOTOR DRIVEN BY THIS AC DRIVE. CONSIDER THE POWER SUPPLY SYSTEM, INSTALLATION PLACE AND WIRING METHOD BEFORE INSTALLATION.

INSTALL THIS AC DRIVE AWAY FROM DEVICES THAT HANDLE MINUTE SIGNALS, SUCH AS MEDICAL EQUIPMENT IN PARTICULAR. ALSO SEPARATE THE DEVICES ELECTRICALLY, AND TAKE SUFFICIENT NOISE MEASURES.

• TAKE SUFFICIENT SAFETY MEASURES WHEN USING THIS AC DRIVE FOR PASSENGER TRANSPORTATION, SUCH AS IN ELEVATORS (LIFTS).

Precautions For Safety

Items to be observed to prevent physical damage or property damage and to ensure safe use of this product are noted on the product and in this instruction manual.

- Please read this instruction manual and enclosed documents before starting operation to ensure correct usage. Thoroughly understand the device, safety information and precautions before starting operation. After reading, always store this manual where it can be accessed easily.

- The safety precautions are ranked as "**DANGER**" and "**CAUTION**" in this instruction manual.

: When a dangerous situation may occur if handling is mistaken, leading to fatal or major injuries.

: When a dangerous situation may occur if handling is mistaken, leading to medium or minor injuries, or physical damage.

Note that some items described as 

may lead to major problems depending on the situation. In any case, important information that must be observed is described.

This instruction manual is written on the presumption that the user has an understanding of the AC Drive. A qualified person must do installation, operation, maintenance and inspection of this product. Even qualified persons must undergo periodic training.

Qualified refers to satisfying the following conditions.

- ✓ The person has thoroughly read and understood this instruction manual.
- ✓ The person is well versed in the installation, operation, maintenance and inspection of this product, and understands the possible dangers.
- ✓ The person is informed on matters related to starting, stopping, installation, locks and tag displays, and has been trained in the operation and remedies.
- ✓ The person has been trained on the maintenance, inspection and repairs of this product.
- ✓ The person has been trained on protective tools used to ensure safety.

KEEP SAFETY FIRST IN YOUR SYSTEM

AMTECH puts the maximum effort into making products better and more reliable, but there is always the possibility that trouble may occur with them. Trouble with AC Drive may lead to personal injury, fire or property damage. Remember to give due consideration to safety when making your system, with appropriate measures such as isolating devices, mechanical brakes, prevention against any malfunction or mishap.

CHAPTER-1: DELIVERY, INSPECTION AND STORAGE

CAUTION

- ✓ Always transport the product with an appropriate method according to the products weight.
  Failure to observe this could lead to injuries.
- ✓ Do not place the product near inflammable items.
  Failure to observe this could lead to fires.
- ✓ Do not hold the product with front cover while transporting the product.
  Failure to observe this could lead to injuries from dropping.
- ✓ Do not let conductive materials such as screws or metal pieces and inflammable materials such as oil enter the product.
  Failure to observe this could lead to fires.
- ✓ Install the product in a place that can withstand the weight of the product, and follow the instruction manual.
  Failure to do so could lead to injuries from dropping.
- ✓ Do not install and operate an AC Drive that is damaged or that has missing parts.
  Failure to observe this could lead to injuries.
- ✓ Always observe the conditions described in the instruction manual for the installation environment.
  Failure to observe this could lead to faults.

1-1 Delivery, inspection and storage

Axpert-Eazy Series AC Variable Frequency Drive has gone through rigorous quality control tests at the factory before shipment. After receiving the AC drive, check for the following.

(1) Check to make sure that the package includes an AC Variable Frequency Drive and User Manual

(2) Remove the unit from packaging, and check the details on the rating nameplate to confirm that the AC DRIVE is as ordered.

(3) Confirm that the product has not been damaged during shipment.

The *Axpert-Eazy* Series AC Variable Frequency Drive should be kept in the shipping carton before installation. In order to retain the warranty coverage, the AC Drive should be stored properly when it is not to be used for an extended period of time. Some storage suggestions are:

(1) Store in a clean, dry location.

(2) Store within an ambient temperature range of -20℃ (-4℉) to +60℃ (140℉).

(3) If possible, store in an air-conditioned environment where the relative humidity is less than 95%, non-condensing.

(4) Do not store the AC Variable Frequency Drive in places where it could be exposed to corrosive gases.

(5) Do not store the AC Variable Frequency Drive on a shelf or on an unstable surface.

(6) If the AC Variable Frequency Drive is not to be used for a while (more than 2 months) after purchasing, store it in a place with no humidity or vibration in the packaged state.

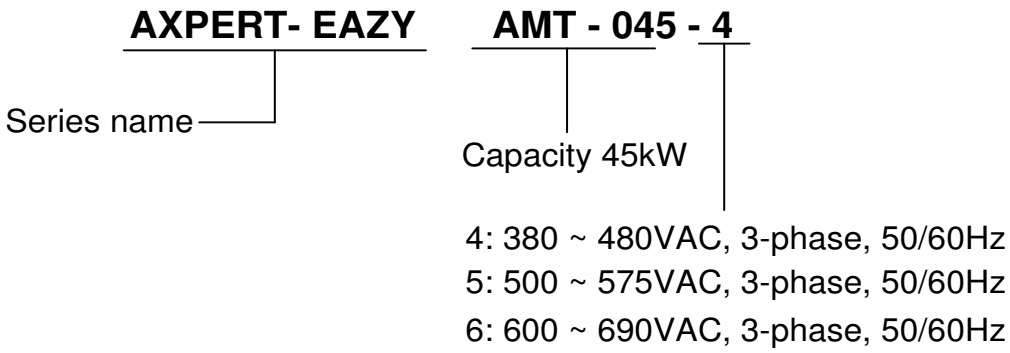
(7) Always inspect the AC Variable Frequency Drive before using after storing for a long period.

1-2 Details of rating nameplate and type display method

The following details are listed on the rating nameplate.

MODEL AXPERT-EAZY	: AMT-045-4	KW: 45
INPUT AC 3-PHASE	: 380 - 480V,	50 / 60Hz
OUTPUT AC 3-PHASE	: 380 - 480V,	0.10 ~ 600.00Hz
OUTPUT CURRENT	: 87A	
SERIAL NO	: XXXXX	

Using the above type as an example, the type is displayed as follows:



CHAPTER-2: INSTALLATION AND WIRING

This chapter provides the information needed to properly **install** and **wire** the AC Drive. Make sure that the AC Drive is wired according to the instructions contained in this chapter. The instructions should be read and understood before the actual installation begins.

⚠ CAUTION

- ✓ Install the AC Drive, dynamic braking unit and resistor, and other peripheral devices on noncombustible material such as metal.
  Failure to observe this could lead to fires.
- ✓ **Do not mount unit in horizontal position. Always mount unit in Vertical position only.**
  Failure to observe this could lead to damage the unit.
- ✓ Do not place the product near inflammable items.
  Failure to observe this could lead to fires.
- ✓ Do not let conductive materials such as screws or metal pieces and inflammable materials such as oil enter the product.
  Failure to observe this could lead to fires.
- ✓ Install the product in a place that can withstand the weight of the product.
  Failure to do so could lead to injuries from dropping.
- ✓ Do not install and operate AC Drive that is damaged or that is missing parts.
  Failure to observe this could lead to injuries.
- ✓ Always observe the conditions described in the instruction manual for the installation environment.
  Failure to observe this could lead to faults.
- ✓ Install an overheating protection device on the dynamic braking resistor, and shut off the power with this fault signal.
  Failure to do so could lead to fires in the event of abnormal overheating.

2-1 Installation environment

Observe the following points when installing the AC Drive.

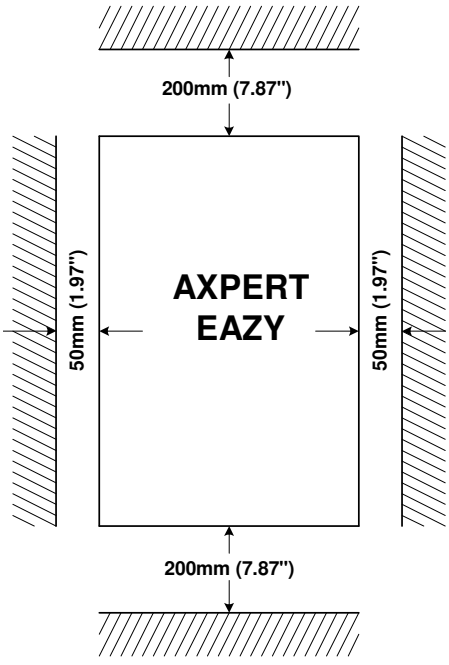
(1) Install the AC Drive vertically to provide proper ventilation.

(2) Make sure that the ambient temperature is 0℃ (32℉) to 50℃ (122℉) for 400 Volt series Drive and 0℃ (32℉) to 40℃ (104℉) for 500 Volt and 600 Volt series Drive.

(3) Avoid installation in the following environment.

- Places subject to direct sunlight.
- Places with oil mist, dust or cotton lint, or subject to salty winds.
- Places with corrosive gas, explosive gas or high humidity levels.
- Places near vibration sources such as dollies or press machines.
- Places made of in-flammable materials such as wood, or places that are not heat resistant.

(4) Ensure ventilation space around the AC DRIVE as shown in the below figure.



2-2 Precautions for power supply and motor wiring

DANGER

- Always turn the device's input power OFF before starting wiring.
  Failure to do so could lead to electric shocks or fires.
- Carry out grounding that complies with the standards of the country where the AC DRIVE is being installed.
  Failure to do so could lead to electric shocks or fires.
- Wiring must always be done by a qualified electrician
  Failure to observe this could lead to electric shocks or fires.
- Always install the device before starting wiring.
  Failure to do so could lead to electric shocks or injuries.
- Use circuit breaker or fuses that match with the capacity of AC DRIVE power supply.
  Failure to do so could lead to fires.

CAUTION

- ✓ Do not connect an AC power supply to the output terminals (U, V, W) and DC terminals (L+1, L+2, and L–).
  Failure to observe this could lead to injuries or fires.
- ✓ Confirm that the product's rated input voltage and frequency match the power supply voltage and frequency.
  Failure to do so could lead to injuries or fires.
- ✓ Install an overheating protection device on the dynamic braking resistor, and shut off the power with this fault signal.
  Failure to do so could lead to fires in the event of abnormal overheating.
- ✓ Do not directly connect a resistor to the DC terminals (L+1, L+2, and L–).
  Failure to observe this could lead to fires.
- ✓ Tighten the terminal screws with the designated tightening torque.
  Failure to do so could lead to fires.
- ✓ Correctly connect the output (U, V, W) to motor terminals to ensure proper phase sequence.
  Failure to do so could cause the motor to rotate in reverse and the machine to be damaged.
- ✓ When using the encoder, ensure its proper connections. The signal polarity specifications differ according to the encoder. If the specifications differ from the specified AC DRIVE standard specifications, correct the signal polarity as specified. Refer Chapter-10 for more information on encoder specifications.
  Failure to observe this could lead to reverse rotation or abnormal acceleration of the motor, and to injuries or machine damage.

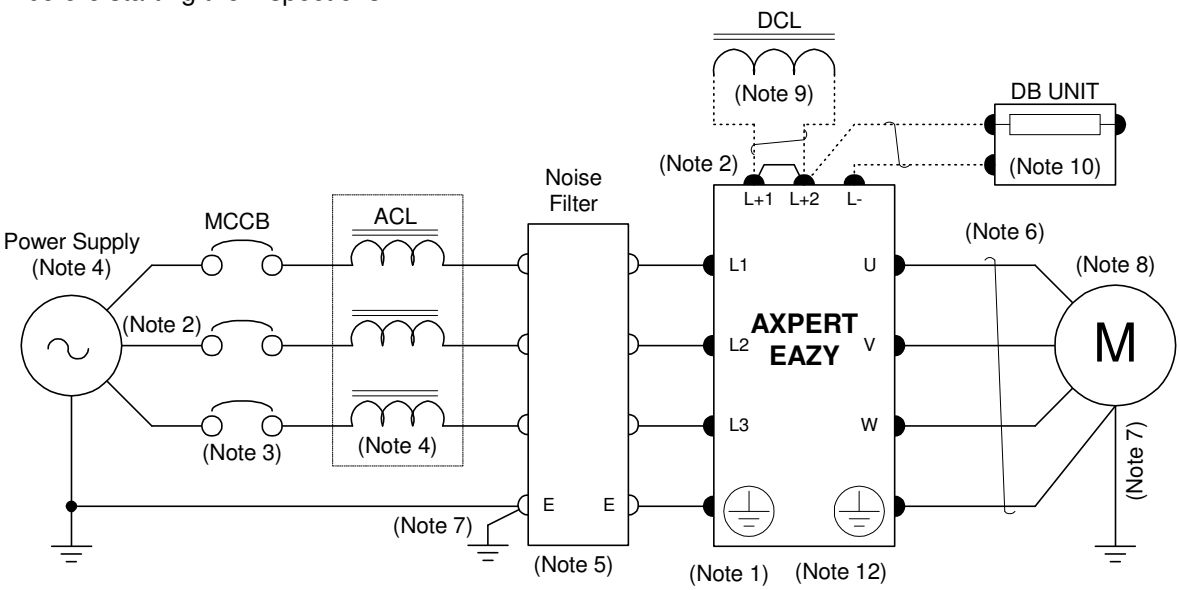
Refer to below figure and wire the main circuits for the power supply and motor, etc.
Always observe the following precautions for wiring.

CAUTION

There is a risk of electric shocks.
The AC DRIVE has a built-in electrolytic capacitor, so a charge will remain even when the AC DRIVE power is turned off. Always observe the following items before carrying out the wiring work.

- ✓ Wait at least 20 minutes after turning the power off before starting work. Make sure that the displays on the Digital Operation Panel have gone out before removing the cover.

✓ After removing the cover, confirm that the “DC BUS CHARGE LED“ in the unit on bleeder board has gone out. Also check that the voltage between terminals L+1 or L+2 and L- is 15V or less before starting the inspections.



EXAMPLE OF MAIN CIRCUIT WIRING

(Note 1) AC DRIVE input / output terminals

The AC DRIVE input terminals are L1, L2 & L3. The output terminals to the motor are U, V & W. Connect the power supply to input terminals L1, L2 & L3 only. Never connect the power supply to the U, V, and W terminals. Incorrect wiring will lead to AC DRIVE damage or fires.

(Note 2) Wire size

Use wires having the size (or larger) shown in the below table for the main circuit wiring shown in the above figure. The applicable wire size range, applicable ring terminal and tightening torque for the main circuit terminals are shown in the Table-1 for 400V Series, Table-2 for 500V Series and Table-3 for 600V Series.

Table-1: 400V Series *Axpert-Eazy* drive (Terminal and applicable wire for Input and Output)

AMT-XXX-4	Rated Current (A)	Wire size		Lug size max+	Lug ID mm (inch)	Lug width mm (inch)	Terminal width mm (inch)		Hole diameter mm (inch)	Terminal screw size	Tightening torque N*m (lb-inch)
		mm^2	AWG				I/P	O/P			
011	23	5.5	10	-	-	-	-	-	-	-	1.58 (14)
015	31	8	8	-	-	-	-	-	-	-	1.92 (17)
018	37	14	6	-	-	-	-	-	-	-	1.92 (17)
022	44	14	6	-	-	-	-	-	-	-	1.92 (17)
030	60	35	2	-	-	-	-	-	-	-	2.26 (20)
037	72	35	2	-	-	-	-	-	-	-	2.26 (20)
045	87	50	1	-	-	-	-	-	-	-	4.3 (38)
055	110	50	1	-	-	-	-	-	-	-	4.3 (38)
075	147	85	3/0	85 x M10	11.0 (0.43)	25.5 (1.00)	19 (0.75)		11.0 (0.43)	M10	22.5 (199)
090	175	120	4/0	120 x M10	11.0 (0.43)	28.3 (1.11)	19 (0.75)		11.0 (0.43)	M10	22.5 (199)
110	215	50 x 2p	1/0 x 2p	50 x M10 x 2p	11.0 (0.43)	18.5 (0.73)	30 (1.18)		11.0 (0.43)	M10	22.5 (199)
132	245	70 x 2p	2/0 x 2p	70 x M10 x 2p	11.0 (0.43)	21.4 (0.84)	30 (1.18)		11.0 (0.43)	M10	22.5 (199)
160	320	85 x 2p	3/0 x 2p	85 x M10 x 2p	13.0 (0.51)	25.5 (1.00)	30 (1.18)		11.0 (0.43)	M10	22.5 (199)
200	360	120 x 2p	4/0 x 2p	120 x M12 x 2p	13.0 (0.51)	28.3 (1.11)	40 (1.58)	38 (1.50)	13.0 (0.51)	M12	31.2 (276)
250	470	185 x 2p	400 x 2p	185 x M12 x 2p	13.0 (0.51)	34.2 (1.35)	40 (1.58)	38 (1.50)	13.0 (0.51)	M12	31.2 (276)
315	530	300 x 2p	500 x 2p	300 x M12 x 2p	17.0 (0.67)	44.0 (1.73)	40 (1.58)	38 (1.50)	17.0 (0.67)	M16	85.0 (752)
355	600	400 x 2p	600 x 2p	400 x M12 x 2p	17.0 (0.67)	51.0 (2.01)	40 (1.58)	38 (1.50)	17.0 (0.67)	M16	85.0 (752)

Table-2: 500V Series *Axpert-Eazy* drive (Terminal and applicable wire for Input and Output)

AMT-XXX-5	Rated Current (A)	Wire size		Lug size max+	Lug ID mm (inch)	Lug width mm (inch)	Terminal width mm (inch)		Hole diameter mm (inch)	Terminal screw size	Tightening torque N*m (lb-inch)
		mm^2	AWG				I/P	O/P			
011	20	6	10	-	-	-	-	-	-	-	1.92 (17)
015	23	6	10	-	-	-	-	-	-	-	1.92 (17)
018	30	10	8	-	-	-	-	-	-	-	1.92 (17)
022	37	10	8	-	-	-	-	-	-	-	1.92 (17)
030	46	16	6	-	-	-	-	-	-	-	1.92 (17)
037	54	25	4	-	-	-	-	-	-	-	4.3 (38)
045	73	25	4	-	-	-	-	-	-	-	4.3 (38)
055	87	35	2	-	-	-	-	-	-	-	4.3 (38)
075	110	50	1/0	50 x M10	11.0 (0.43)	18.5 (0.73)	19 (0.75)		10.5 (0.41)	M10	22.5 (199)
090	135	70	2/0	70 x M10	11.0 (0.43)	21.4 (0.84)	19 (0.75)		10.5 (0.41)	M10	22.5 (199)
110	150	90	3/0	90 x M10	11.0 (0.43)	25.5 (1.0)	19 (0.75)		10.5 (0.41)	M10	22.5 (199)
132	175	50 x 2p	1/0 x 2p	50 x M10 x 2p	11.0 (0.43)	18.5 (0.73)	30 (1.18)		11.0 (0.43)	M10	22.5 (199)
160	215	70 x 2p	2/0 x 2p	70 x M10 x 2p	11.0 (0.43)	21.4 (0.84)	30 (1.18)		11.0 (0.43)	M10	22.5 (199)
200	290	90 x 2p	3/0 x 2p	90 x M12 x 2p	13.0 (0.51)	25.5 (1.0)	40 (1.58)	38 (1.50)	13.0 (0.51)	M12	31.2 (276)
250	345	150 x 2p	250 kcmil x 2p	150 x M12 x 2p	13.0 (0.51)	31.0 (1.22)	40 (1.58)	38 (1.50)	13.0 (0.51)	M12	31.2 (276)
315	390	185 x 2p	300 kcmil x 2p	185 x M12 x 2p	13.0 (0.51)	34.2 (1.35)	40 (1.58)	38 (1.50)	13.0 (0.51)	M12	31.2 (276)

Table-3: 600V Series *Axpert-Eazy* drive (Terminal and applicable wire for Input and Output)

AMT-XXX-6	Rated Current (A)	Wire size		Lug size max+	Lug ID mm (inch)	Lug width mm (inch)	Terminal width mm (inch)		Hole diameter mm (inch)	Terminal screw size	Tightening torque N*m (lb - inch)
		mm^2	AWG				I/P	O/P			
011	15	4	12	-	-	-	-	-	-	-	1.92 (17)
015	20	6	10	-	-	-	-	-	-	-	1.92 (17)
018	22	6	10	-	-	-	-	-	-	-	1.92 (17)
022	30	10	8	-	-	-	-	-	-	-	1.92 (17)
030	37	10	8	-	-	-	-	-	-	-	1.92 (17)
037	46	16	6	-	-	-	-	-	-	-	1.92 (17)
045	54	25	4	-	-	-	-	-	-	-	4.3 (38)
055	72	25	4	-	-	-	-	-	-	-	4.3 (38)
075	87	35	2	-	-	-	-	-	-	-	4.3 (38)
090	110	50	1/0	50 x M10	11.0 (0.43)	18.5 (0.73)	19 (0.75)		10.5 (0.41)	M10	22.5 (199)
110	135	70	2/0	70 x M10	11.0 (0.43)	21.4 (0.84)	19 (0.75)		10.5 (0.41)	M10	22.5 (199)
132	150	90	3/0	90 x M10	11.0 (0.43)	25.5 (1.0)	19 (0.75)		10.5 (0.41)	M10	22.5 (199)
160	175	50 x 2p	1/0 x 2p	50 x M10 x 2p	11.0 (0.43)	18.5 (0.73)	30 (1.18)		11.0 (0.43)	M10	22.5 (199)
200	215	70 x 2p	2/0 x 2p	70 x M10 x 2p	11.0 (0.43)	21.4 (0.84)	30 (1.18)		11.0 (0.43)	M10	22.5 (199)
250	290	90 x 2p	3/0 x 2p	90 x M12 x 2p	13.0 (0.51)	25.5 (1.0)	40 (1.58)	38 (1.50)	13.0 (0.51)	M12	31.2 (276)
315	345	150 x 2p	250 kcmil x 2p	150 x M12 x 2p	13.0 (0.51)	31.0 (1.22)	40 (1.58)	38 (1.50)	13.0 (0.51)	M12	31.2 (276)
355	387	185 x 2p	300 kcmil x 2p	185 x M12 x 2p	13.0 (0.51)	34.2 (1.35)	40 (1.58)	38 (1.50)	13.0 (0.51)	M12	31.2 (276)

+2p = Two parallel

(Note 3) Breaker for wiring

Install circuit breaker or fuse on the power supply side of the AC DRIVE. Refer to table and select the Circuit Breaker or Fuses.

(Note 4) Power supply capacity

Make sure that the capacity of the transformer used as the AC DRIVE's power supply is 10 times (or less) AC DRIVE capacity (for 4% impedance transformer). If the above value is exceeded, install an ACL on the AC DRIVE's input side.

(Note 5) Noise filter

The AC DRIVE will generate high harmonic electromagnetic noise, so using the following noise measures is recommended.
Insert a noise filter on the input side of the AC DRIVE. Contact Amtech to select the proper noise filter.
Keep the wiring length between the noise filter and AC DRIVE to 500mm (19.7") or less.

Use a shield cable for the AC DRIVE and motor wiring and connect the screen to the AC DRIVE's  terminal.
When using the control circuit wiring and power circuit wiring in parallel, separate the wiring by 300mm (11.8") or more or pass each of the wiring through separate metal conduits. If the control circuit wiring and main circuit wiring intersect, make sure that they intersect at a right angle.

(Note 6) AC DRIVE output

Do not insert a power factor improvement capacitor on the output side of the AC DRIVE. When inserting a magnetic contactor on the output side of the AC DRIVE, prepare a sequence control circuit so that the magnetic contactor will not open and close when the AC DRIVE is running. Directly connect only motor to the AC DRIVE load and do not connect through a transformer etc...without consulting Amtech.

(Note 7) Grounding

Always ground the AC DRIVE unit according to the regulations of the country where the AC DRIVE is being used to ensure personnel safety in all circumstances, and to reduce electromagnetic emission and pickup.
Make sure that grounding conductors are adequately sized as required by safety regulations.
In a multiple-drive installation, connect each drive separately to protective earth.

In European CE compliant installations and in other installations where EMC emissions must be minimized, make a 360° high frequency grounding of cable entries in order to suppress electromagnetic disturbances.
In addition, connect the cable shields to protective earth (PE) in order to meet safety regulations.

As the normal leakage current of the drive is higher than 3.5 mA AC or 10 mA DC (stated by EN 50178, 5.2.11.1), a fixed protective earth connection is required.

(Note 8) AC DRIVE output surge voltage

As the AC DRIVE output cable is lengthened, the surge voltage applied on the motor also increases. If the wiring between the AC DRIVE and motor exceeds 20meters (65.6'), connect a surge absorber dedicated for the AC DRIVE output.

(Note 9) DCL

Always short across L+1 and L+2 when not using the DCL (factory setting state). When connecting the optional DCL, connect it to L+1 and L+2. Twist the wiring to the DCL, and keep the wiring length to 5meters (16.4') or less.

(Note 10) DB Unit

When connecting an optional DB unit, make the connections as shown in the main circuit wiring. The DB unit and AC DRIVE unit will damage if the connections are incorrect. Twist the wiring to the DB unit, and keep length to 3meters (9.8') or less.
When using the external DB unit, use the overload detection relay or thermal relay to protect the DB resistor and AC DRIVE.

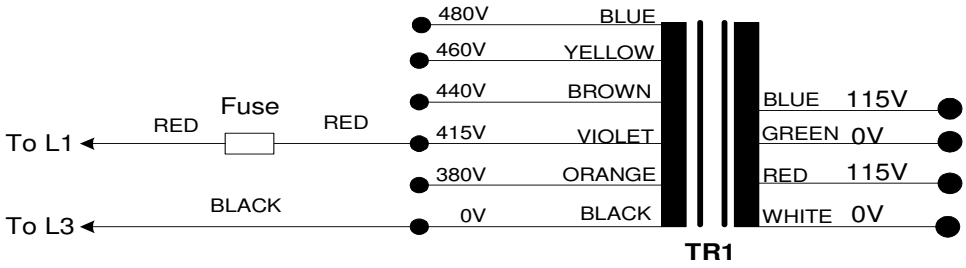
(Note 11) Surge absorber

Install a surge absorber on the magnetic contactor and relay coils installed near the AC DRIVE.

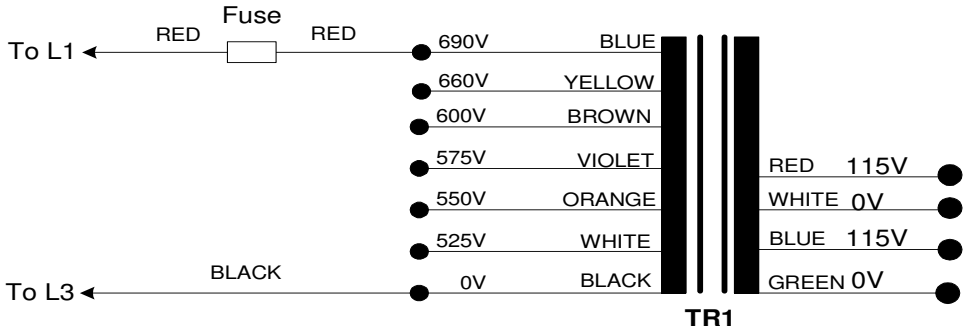
(Note 12) Voltage Selection for the auxiliary equipment Power Supply

Ensure appropriate tapping for the control transformer, which provides the power supply to the auxiliary equipments like fan/blower, soft charge contactor etc.

- **400V Series**

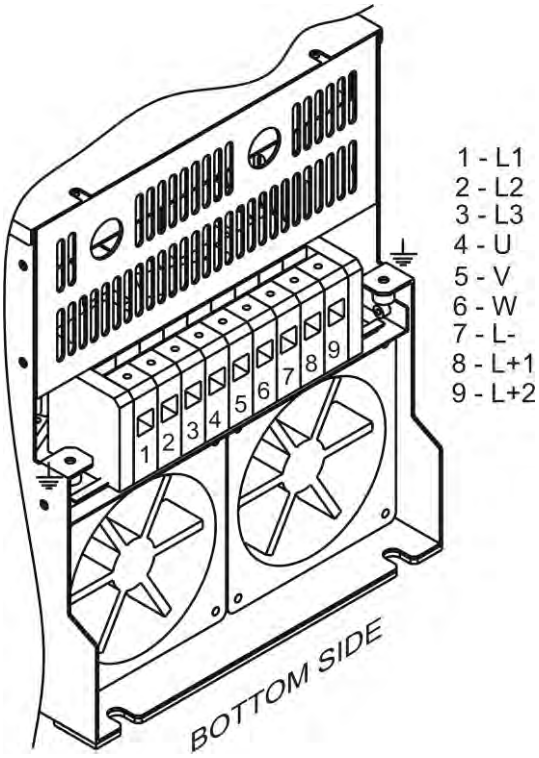


- **500V / 600V Series**

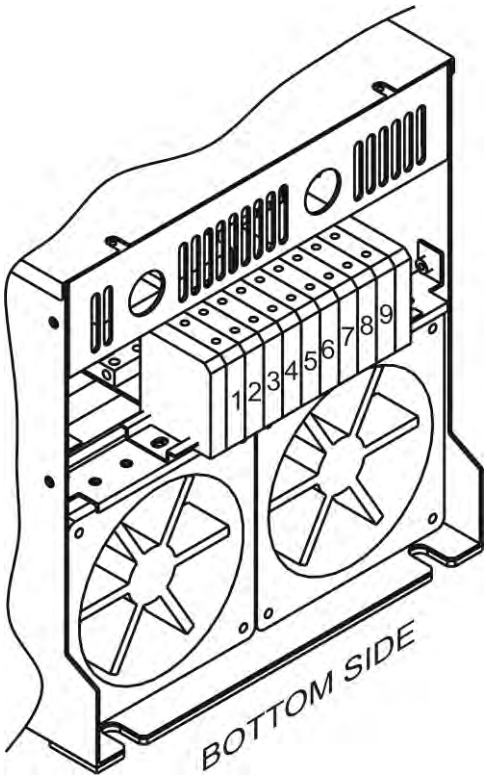


2-3 Power terminal layout

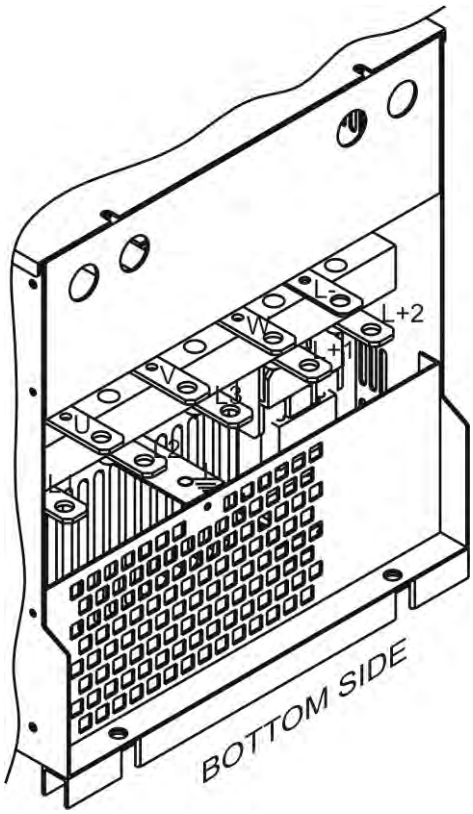
400V Series
AMT-011-4, AMT-015-4, AMT-018-4
AMT-022-4
500V Series
AMT-011-5, AMT-015-5, AMT-018-5,
AMT-022-5, AMT-030-5
600V Series
AMT-011-6, AMT-015-6, AMT-018-6,
AMT-022-6, AMT-030-6, AMT-037-6



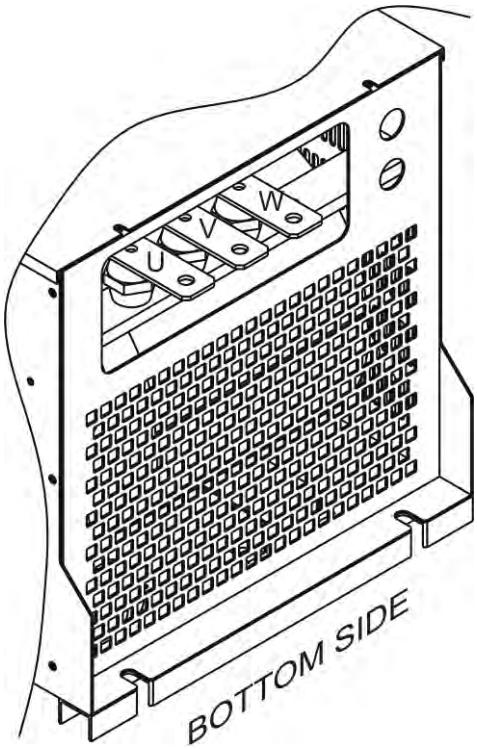
400V Series
AMT-030-4, AMT-037-4, AMT-045-4, AMT-055-4
500V Series
AMT-037-5, AMT-045-5, AMT-055-5
600V Series
AMT-045-6, AMT-055-6, AMT-075-6

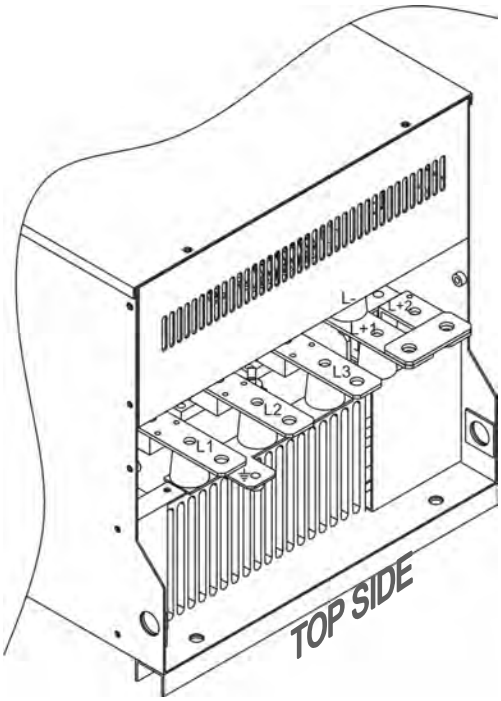


400V Series
AMT-075-4, AMT-090-4
500V Series
AMT-132-5, AMT-090-5, AMT-110-5
600V Series
AMT-090-6, AMT-110-6, AMT-132-6



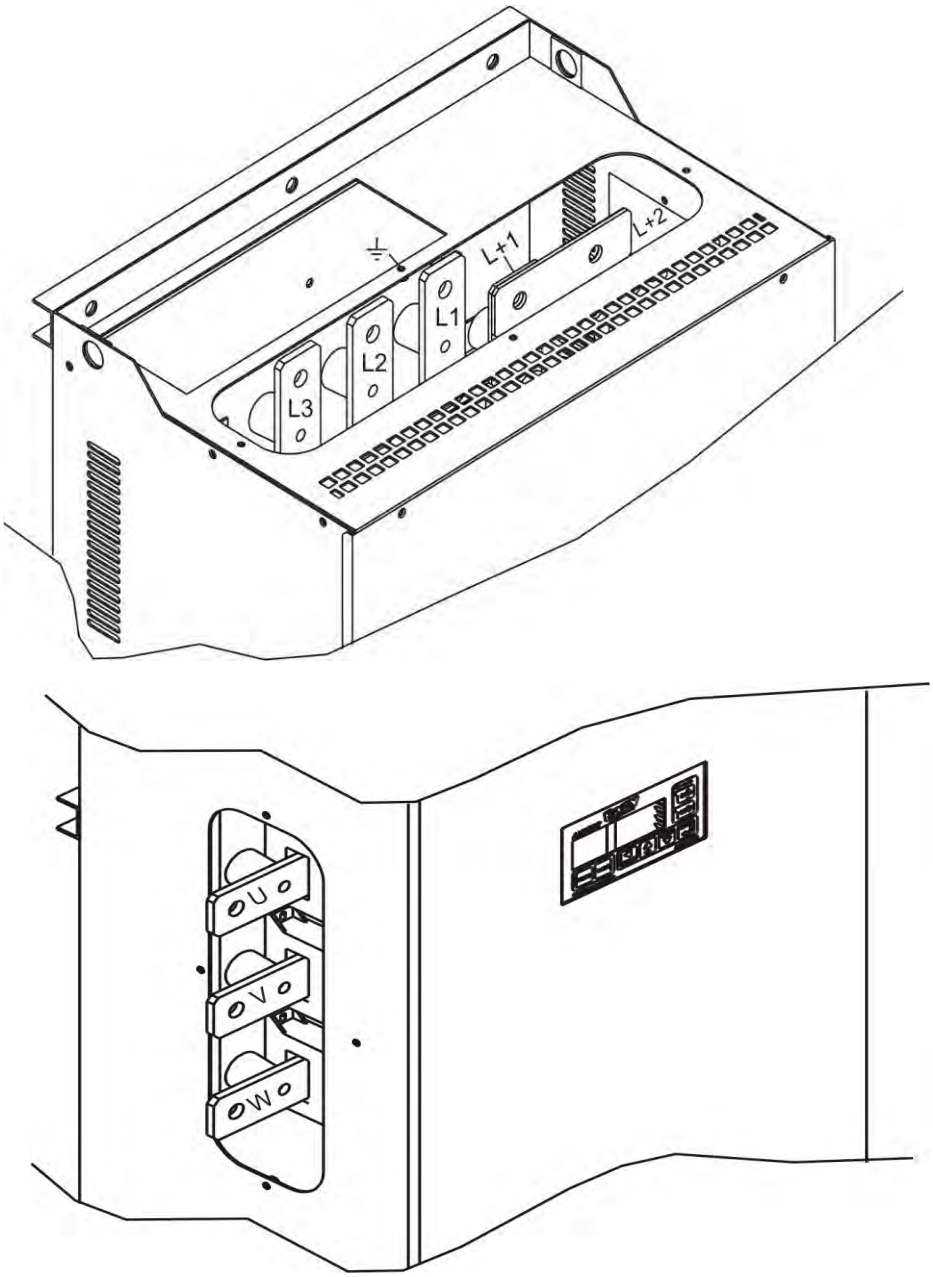
400V Series
AMT-110-4, AMT-132-4, AMT-160-4
500V Series
AMT-132-5, AMT-160-5
600V Series
AMT-160-6, AMT-200-6





400V Series

AMT-200-4, AMT-250-4



400V Series

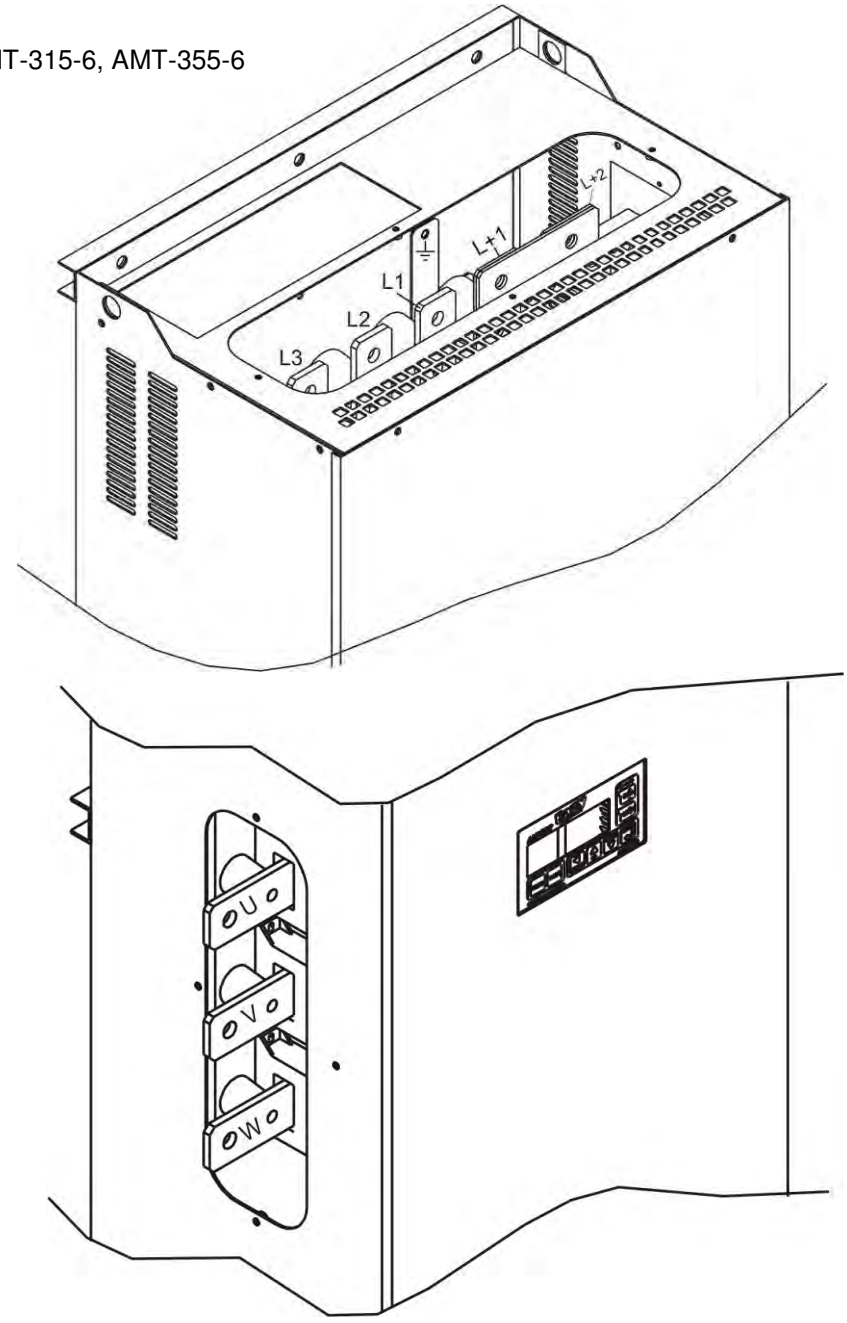
AMT-315-4, AMT-355-4

500V Series

AMT-200-5, AMT-250-5, AMT-315-5

600V Series

AMT-250-6, AMT-315-6, AMT-355-6



2-4 Precautions for control signals wiring

- ✓ When wiring (control circuit wiring) to the control terminal block, separate the main circuit wiring (terminals L1, L2, L3, L+1, L+2, L-, U, V, W) and the other drive wires and power wires.
- ✓ Use a 0.13mm^2 (AWG 26) to 0.8mm² (AWG 18) wire for wiring to the control circuit. The tightening torque must be 0.6N.m (5.3lb-inch).
- ✓ Use a twisted pair wire or twisted pair shield wire for wiring to the analog signal circuit such as the analog references and meters. Connect the shield wire to the 0V terminal of the unit. The wire length must be 30meters (98.4') or less.
- ✓ The length of the sequence input/output contact wire must be 50meters (164') or less.
- ✓ The sequence input can be changed between sink logic and source logic by changing the jumper position JP1 in PCA-2014A/PCA-2004A between "SINK" and "SOURCE" position respectively. Open cover designated as "Control Unit" to access this jumper.
- ✓ Observe the precautions listed in "**5. Control Input/Output Terminals**".
- ✓ After wiring, always check the mutual wiring.
- ✓ At this time do not carry out a megger check or buzzer check on the control circuit.

  • Are there any wire scraps or foreign matter left around the terminals?
  • Are any screws loose?
  • Is the wiring correct?
  • Is any terminal contacting any other terminal?

If so, take the necessary corrective measures before proceeding further.

Fiber Optic Cables

⚠ CAUTION

Handle the fiber optic cables with care. When unplugging optic cables, always grab the connector, not the cable itself. Do not touch the ends of the fibers with bare hands, as the fiber is extremely sensitive to dirt. The minimum allowed bend radius is 35mm (1.4").

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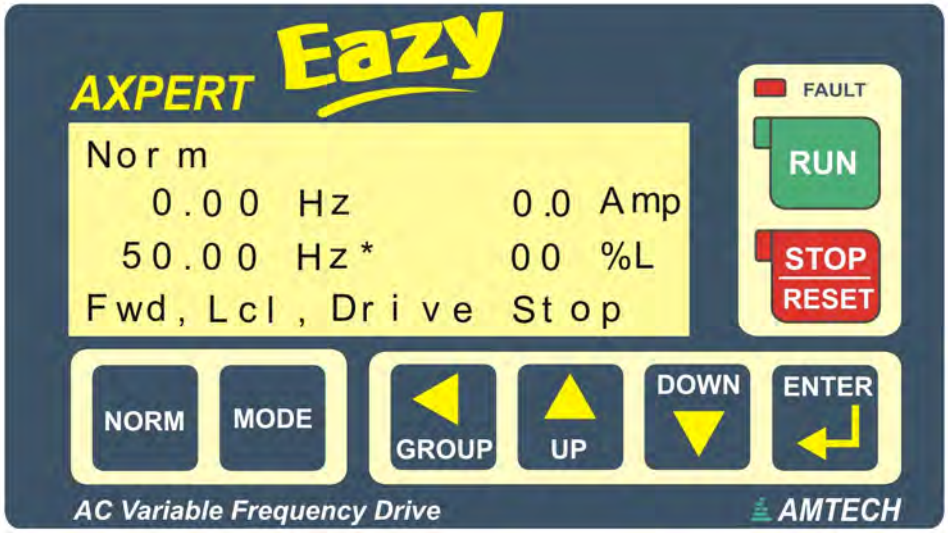
CHAPTER-3: DIGITAL OPERATION PANEL (LCD KEYPAD MODULE)

The configuration of the Digital Operation Panel is shown in the below figure. The structure of it is as shown below.



The Digital Operation Panel is equipped with 8-keys as shown in the above figure. The function of each key is described below.

This key is utilized to reach to the normal screen of digital operator panel from any parameter, group or mode. The normal screen displays different parameters and status. This is the screen displayed at power on.

This key when pressed, passes the control to next successive modes i.e. NORM (Normal), MODE-M (Monitor), MODE-A, MODE-B, MODE-C, MODE-D… & Meter mode. After the end of all modes, it will carry the control again to first mode. When changing the mode, the last accessed parameter of last accessed group of successive mode will be displayed.

This key passes the control to next group in the same mode. The groups can be accessed only in the incremental direction. At last it will again come to the first group.
If "ENTER" key is pressed, this key is used to move the cursor position for parameter value change.

These keys are used to change parameter numbers & parameter value. When ENTER key is pressed, these keys are used to change the parameter value, otherwise it is used to navigate the parameters in upward / downward direction in the group.

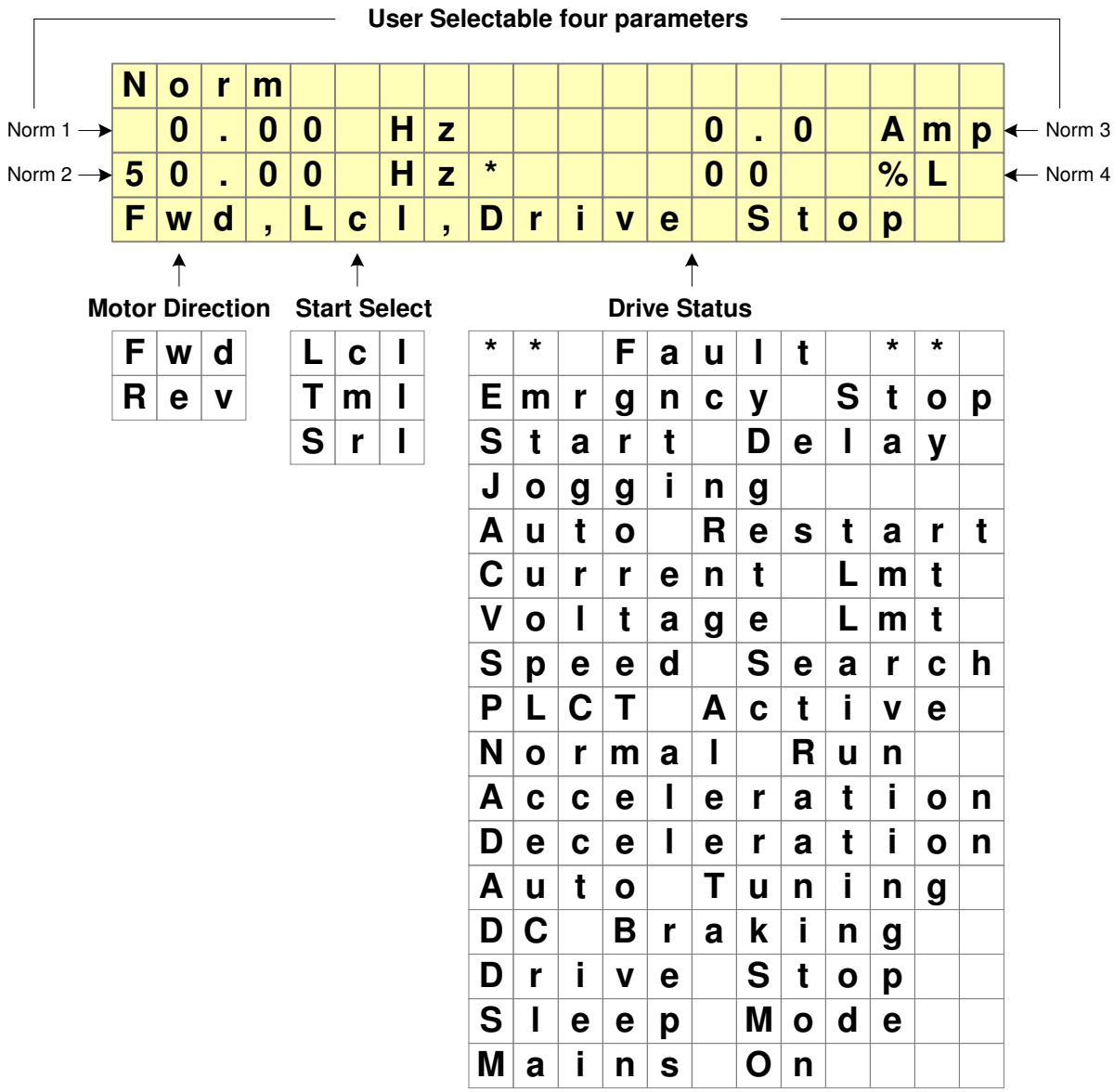
This key is used to change and save the parameter value. When pressed first time, it will allow the user to change the parameter value using up and down keys. Once the desired value is set, it is pressed again to save the change value. Press NORM key instead of ENTER, to discard the change.

This key is used to start the AC DRIVE when the start control is through Digital Operation Panel. The key is equipped with the status indicating LED. It will glow, when the AC DRIVE is running.

This key is used to stop the AC DRIVE in LOCAL mode (keypad) only. When stop key is pressed for 2.5 seconds or longer during operation, the drive will coast to stop regardless of Local or Terminal start control. It is also used to reset the fault. The stop key is equipped with status indicating LED. It will glow when the AC DRIVE is off.

The Digital Operation Panel is also equipped with the fault indicating LED. It will flash in the fault condition. It is also equipped with four lines, 20-character LCD display for the user-friendly parameter navigation, monitoring and setting.

In the normal condition the screen will be as below.



The above figure also indicates the selected direction of rotation, start selection and drive status. The four user selectable parameters can be configured using A601 ~ A604.

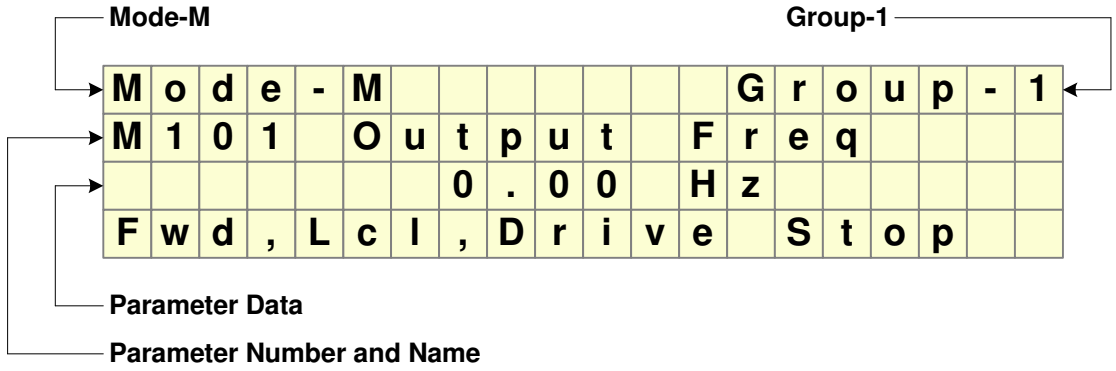
3-1 Drive Status

The fourth line of the Digital Operation Panel (LCD Keypad Module) is used to display different status of the unit as shown above**.** More than one status can exist at one time. In this case, the status having higher priority will be displayed. The priority is as shown in the figure. Fault has the highest priority and mains on have least priority.

NO	NAME	DESCRIPTION
1	*Fault*	It indicates that some fault has occurred in the unit.
2	*Emergency Stop*	It shows that the unit is stopped due to emergency stop command.
3	*Start Delay*	It shows that the start is delayed by the programmed start delay.
4	*Jogging*	It shows that the jog select input is active and present operation is jogging.
5	*Auto Restart*	It shows that auto restart function is in operation.
6	*Current Limit*	It shows that the current limit function is active.

7	*Voltage Limit*	It shows that the dc bus voltage control function is active.
8	*Speed Search*	It shows that the speed search operation is in progress.
9	*PLCT Active*	It shows that the Power-Loss-Carry-Through function is in progress.
10	*Normal Run*	It shows that ramp up / down action is over and unit is running in normal condition.
11	*Acceleration*	It shows that the unit is accelerating to the set speed.
12	*Deceleration*	It shows that the unit is decelerating.
13	*Auto Tuning*	It shows that the auto tuning function is activated and the process is on.
14	*DC Braking*	It shows that the dc braking is active.
15	*Drive Stop*	It shows that the AC DRIVE is in stop condition.
16	*Sleep Mode*	It shows that the AC DRIVE is in sleep mode.
17	*Mains On*	It shows that the mains power supply is ON.

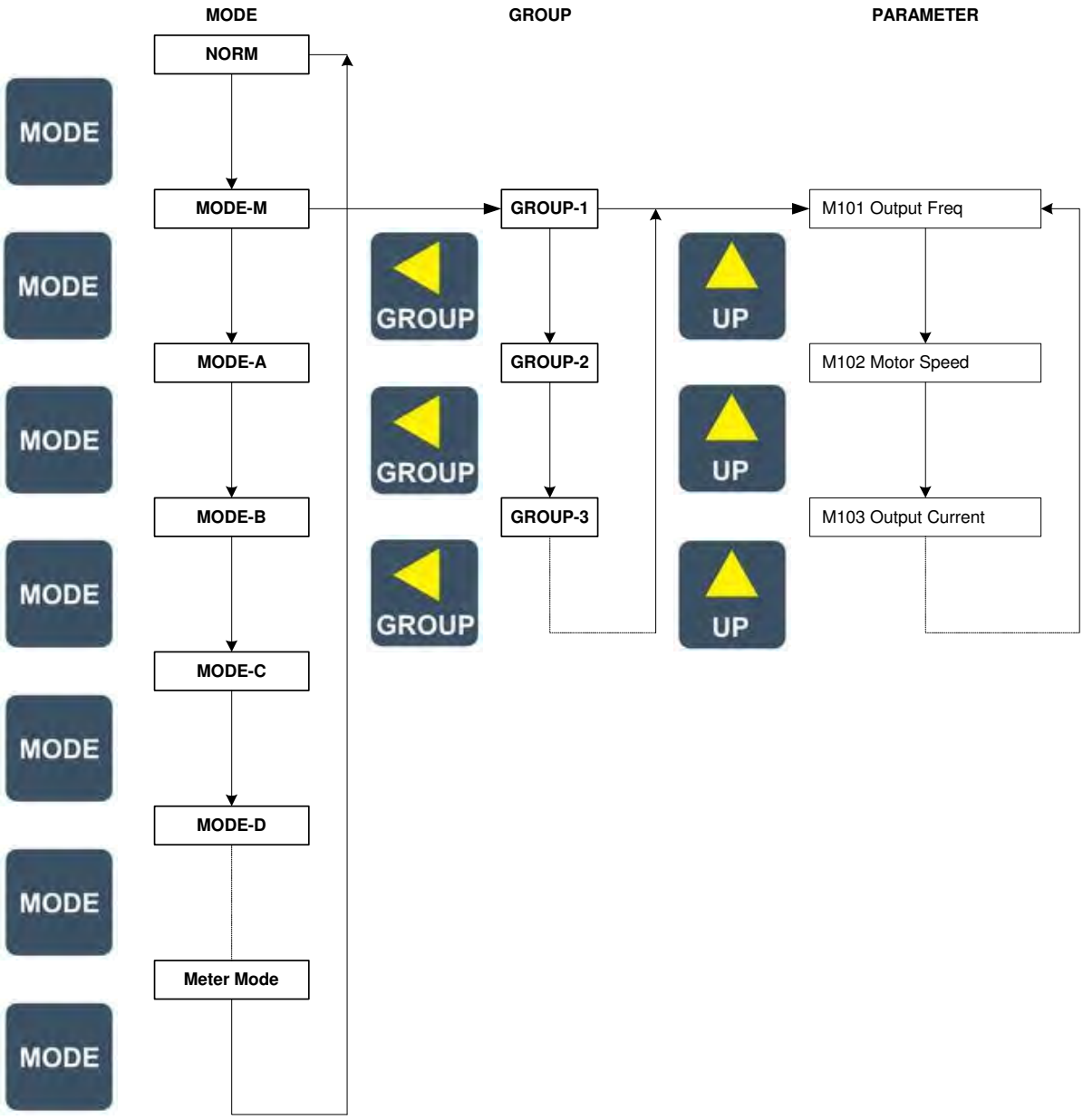
When first time MODE key is pressed, lastly accessed parameter of lastly accessed group of Mode-M will appear with its data. Below figure shows the parameter M101 of Group-1 of Mode-M.



The first line indicates the present mode and group. The second line indicates the parameter number with its name and the third line shows its value. The fourth line shows the present status and remains all the time except fault condition, contact information and fault history.

3-2 Modes & parameters

The parameters are grouped into Modes and Groups according to their functions.
The configuration of the parameters is as under.



3-3 Parameter display & setting

As shown in the above fig, MODE, GROUP, UP & DOWN keys are used to see the parameter value setting. The parameter value (except MODE-M) can be changed using ENTER, GROUP, UP & DOWN keys.

For example, the default local set frequency in A101 is 10.00 Hz. To change the local set frequency to 20.00 Hz, first go to the below screen using the MODE, GROUP, UP and DOWN key.

M	o	d	e	-	A							G	r	o	u	p	-	1
A	1	0	1		L	o	c	a	l		S	e	t		F	r	e	q	
						1	0	.	0	0		H	z						
F	w	d	,	L	c	l	,	D	r	i	v	e		S	t	o	p		

Now, press ENTER key. The least significant digit will start blinking as shown in the below fig.

M	o	d	e	-	A							G	r	o	u	p	-	1
A	1	0	1		L	o	c	a	l		S	e	t		F	r	e	q
						1	0	.	0	0		H	z					
F	w	d	,	L	c	l	,	D	r	i	v	e		S	t	o	p	

The parameter value now can be set to the desired value using UP, DOWN or GROUP keys. When UP or DOWN is pressed, the value will increment or decrement. If GROUP is pressed, the cursor position will move to the left side as shown in the below fig.

M	o	d	e	-	A							G	r	o	u	p	-	1
A	1	0	1		L	o	c	a	l		S	e	t		F	r	e	q
						1	0	.	0	0		H	z					
F	w	d	,	L	c	l	,	D	r	i	v	e		S	t	o	p	

By pressing GROUP key two times again will move the cursor to the most significant digit.

M	o	d	e	-	A							G	r	o	u	p	-	1
A	1	0	1		L	o	c	a	l		S	e	t		F	r	e	q
						1	0	.	0	0		H	z					
F	w	d	,	L	c	l	,	D	r	i	v	e		S	t	o	p	

Now, press UP key once. The value will be incremented by one.

M	o	d	e	-	A							G	r	o	u	p	-	1
A	1	0	1		L	o	c	a	l		S	e	t		F	r	e	q
						2	0	.	0	0		H	z					
F	w	d	,	L	c	l	,	D	r	i	v	e		S	t	o	p	

Once the desired value is set, press ENTER key to save the value. The cursor will stop blinking and the parameter value will be saved to the non-volatile memory. If you do not want to save the new value, do not press ENTER key. Press NORM key or MODE key.

⚠ CAUTION

✓ Do not remove or insert the display cable between PCA-2014A/ PCA-2004A (Main Control Card) and PCA-2012 (Display Card) in power-energized condition.
Failure to observe this could lead to component failure and tripping of the unit.

CHAPTER-4: TEST OPERATION AND ADJUSTMENT

DANGER

- Always install the front cover before turning the input power ON. Never remove the cover while the power is ON. There are sections in the front PCB that are charged with high voltages.
  Failure to observe this could lead to electric shocks.
- Never touch the switches with wet hands.
  Failure to observe this could lead to electric shocks.
- Never touch the AC DRIVE's terminals while the AC DRIVE power is ON even if the operation is stopped.
  Failure to observe this could lead to electric shocks.
- Selection of the restart function could lead to unexpected restarting when a fault occurs. The machine may start suddenly if the power is turned ON, if the run command is present. Do not go near the machine.
  (Design the machine so that physical safety can be ensured even if the machine restarts.)
  Failure to do so could lead to injuries.
- The machine may not stop according to the set deceleration time when a stop command is issued if the ramp down to stop function is selected and the voltage / current limit function is activated. Prepare a separate emergency stop switch in such cases.
  Failure to do so could lead to injuries.
- Resetting of a fault while the run signal is input could lead to restarting. Always confirm that the run signal is OFF before resetting the fault.
  Failure to do so could lead to injuries.

CAUTION

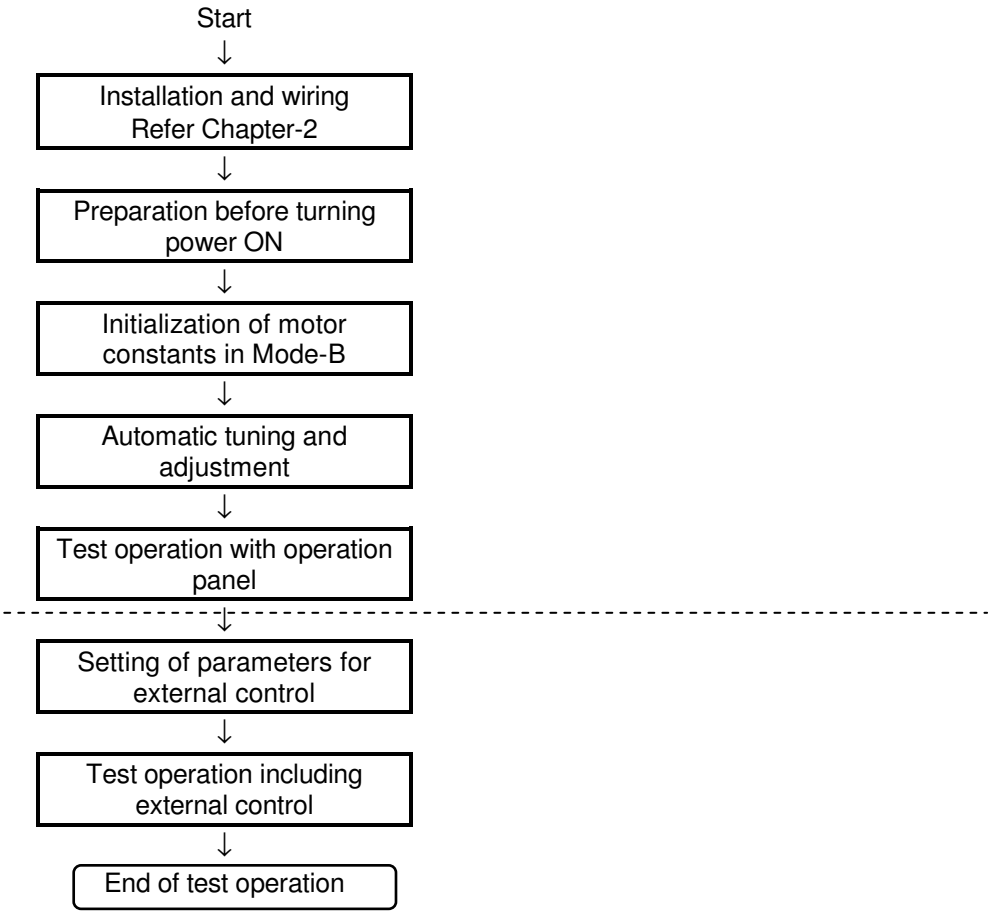
- ✓ The heat sink, chokes and dynamic braking resistor are heated to high temperatures, so never touch them.
  Failure to observe this could lead to burns.
- ✓ Do not block the AC DRIVE's ventilation holes.
  Failure to observe this could lead to fires.
- ✓ The AC DRIVE operation can easily be set from low speeds to high speeds, so confirm that the operation is within the tolerable range for the motor or machine before making settings.
  Failure to do so could lead to injuries.
- ✓ Prepare holding brakes when necessary. Holding is not possible with the AC DRIVE's brake functions.
  Failure to do so could lead to injuries.
- ✓ Confirm the operation of the motor as a single unit before operating the machine.
  Failure to do so could lead to injuries or machine damage due to unforeseen movements.
- ✓ Always prepare a safety backup device so that the machine is not placed in a hazardous situation when an error occurs in the AC DRIVE.
  Failure to do so could lead to injuries or machine damage or fires.

The Axpert Eazy Series AC Drive has various setting items. Some of these include settings that must be made according to the power supply and motor before actually starting the operation.

The method of the basic operation is explained in this section.

Carry out test operation according to the flow shown below.

The procedures above the dotted line in the below fig are explained in this section.



4-1 Preparation before turning power ON

Always confirm the following points before turning ON the power after completing wire.

(1) If problem can occur if the motor runs in reverse direction then remove the coupling and belt coupling the motor and machine, so that the machine can be run as a single unit.

(2) Confirm that the power supply cables are correctly connected to the input terminals (L1, L2, and L3).

(3) There are some sections in the inverter, which operate with an AC power supply, such as fan/blower and magnetic contactor. In this case, select the appropriate tapping of the control transformer on the control terminal block inside the unit. Remove the front cover to access the control terminal block.

(4) Make sure that the power voltage and frequency is within the tolerable range.

(5) Refer to Chapter-2: Installation & Wiring and correctly connect the main circuit wiring.

(6) Securely fix the motor with the specified method.

(7) Make sure that none of the terminal section screws are loose.

(8) Make sure that there is no short circuit state in the terminals caused by wire scraps, etc.

(9) Always correctly install the front cover and outer cover before turning the power ON.

(10) When using the IM vector control with speed sensor mode, make sure that the encoder signal cable is correctly connected to the control card terminal.

(11) Assign an operator, and make sure that the operator operates the switches.

Make sure that there is no abnormal noise, smoke or odors at this time. If any abnormality is found, turn the power OFF immediately.

4-1-1 Selection of control modes

With the *Axpert-Eazy*, Eight control modes can be selected. These are set with the parameter 'A401: Control mode'.

Sets the motor control mode of operation.
A401: Control mode
=1: V/F Open loop Heavy duty Control
=2: V/F Close-loop Heavy duty Control
=3: Sensor-less Heavy duty Vector Control
=4: Close-loop Heavy duty Vector Control
=5: V/F Open loop Normal duty Control
=6: V/F Close-loop Normal duty Control
=7: Sensor-less Normal duty Vector Control
=8: Close-loop Normal duty Vector Control

4-1-2 Selection of start control

The *Axpert-Eazy* AC Drive can be controlled from various places like Digital Operation Panel (Local), Terminal or from PC. Select appropriate start control in A301. Use Digital Operation Panel (Local) during the test operation.

A301: Start Control
=1: Local
=2: Terminal
=3: Serial

4-1-3 Selection of frequency reference input

The *Axpert-Eazy* AC Drive accepts frequency reference from various places like Digital Operation Panel (Local), Terminal or from PC. Select appropriate frequency reference input in A106. Use Digital Operation Panel (Local) during the test operation.

A106: Frequency Reference Input

=1: Local (Digital Operation Panel)	=2: FSV 0-10V
=3: FSI 4-20mA	=4: FSV 0-5V
=5: FSI 0-20mA	=6: FSV 10-0V
=7: FSI 20-4mA	=8: FSV 5-0V
=9: FSI 20-0mA	=10: Static pot
=11: Serial	=12: PID Output
=13: VIN 0-10V	=14: IIN 4-20mA
=15: PLC Analog output-1	=16: PLC Analog output-2
=17: PLC Analog output-3	=18: PLC Analog output-4

Refer the diagram of selection process of frequency reference diagram for the better understanding of the flow frequency reference signal priorities.

4-2 Initialization of motor constants in Mode-B

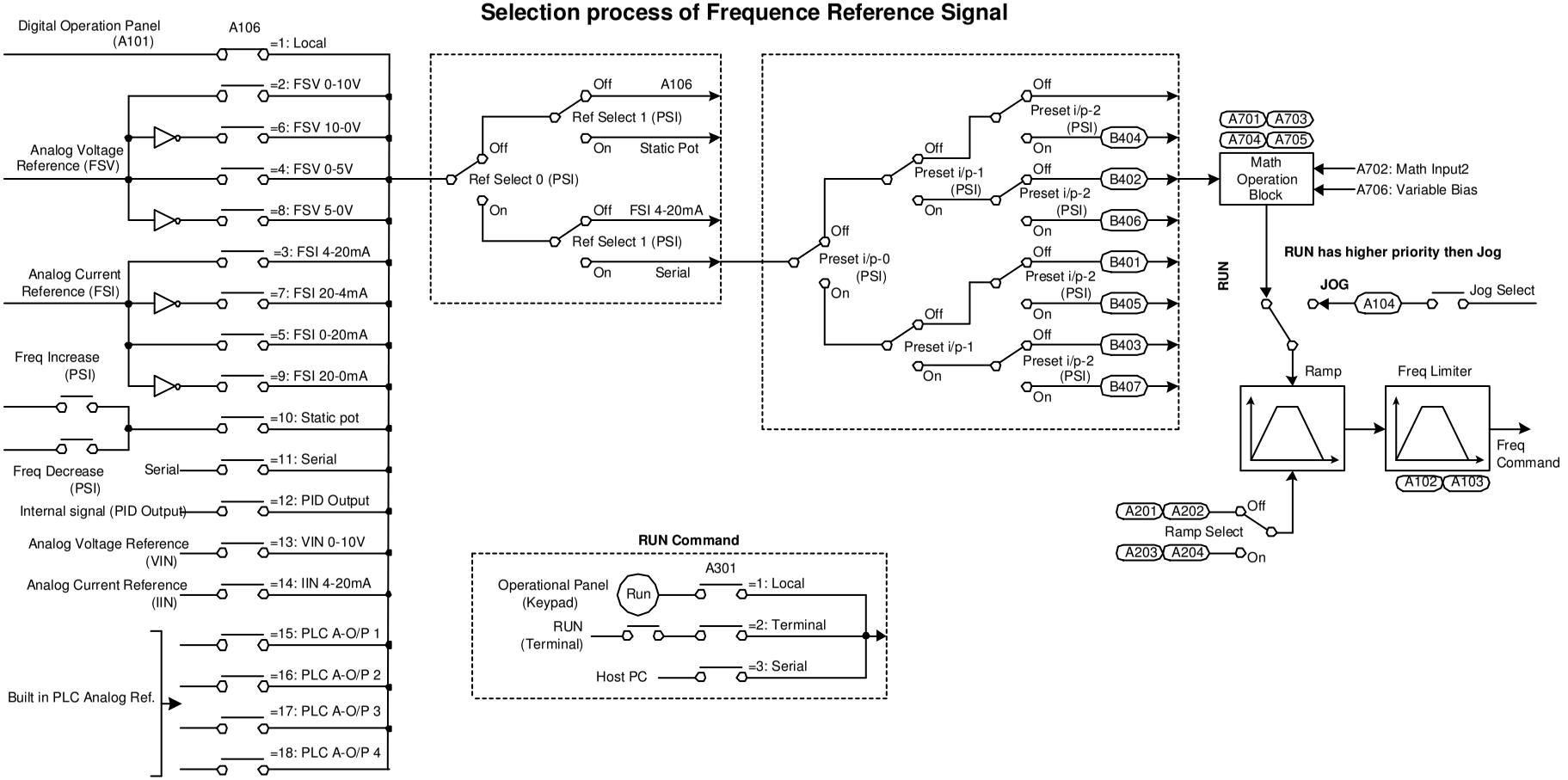
Input the motor rating parameters. Set the following parameters in Mode-B.

B101: Rated Input Voltage (V)
B102: Motor Voltage (V)
B103: Motor Current (A)
B104: Motor Frequency (Hz)
B105: Motor Speed (rpm)
B106: Motor Output (kW)
B107: Motor Poles

Automatic tuning will automatically change the parameters B202~B211, so it is recommended to write down the values set in B202~211.

When using the close-loop vector control mode, input the correct PPR for the encoder in B109. Refer Chapter-10 for the encoder specifications and wiring method.

Selection process of Frequence Reference Signal



4-3 Automatic tuning & adjustment

Automatic tuning measures the constants of the connected motor, and automatically adjusts the parameters so that the system is used to the fullest.

The automatic tuning function performs differ measurements for each of the four control modes. Carry out automatic tuning each time the motor being used or the applicable control mode is changed.

- Set the automatic tuning mode in 'B201: Automatic tuning selection'.
- Press "RUN" key.
- The auto tuning progress is displayed in M303 and the "RUN" LED will blink on the Digital Operation Panel.
- After the Successful completion of the process, M303 will display 10 meaning the auto tuning stage is 100% (complete). If it is 30% complete, it will display 3.

Normal completion of automatic tuning

- When the automatic tuning ends normally, the "RUN" LED will change from a flicker to a stable OFF state.
- The estimated parameters of the motor will be displayed in Mode B, Group 2. Note down the parameters for the future use.

Abnormal completion of automatic tuning

- If automatic tuning ends abnormally, the "FLT" LED will turn ON and the display will blink with the message "Auto Tune Abnormal".
- Investigate and check according to the error codes.
- In case of error, the error code will be displayed in addition to the progress at the time of error. For example, if the error comes at 50% progress with an error code 12, then M303 will display 125. The first two digits display the auto tune error code.

Error code during automatic tuning

Error Code	Significance of error code
01	Problem in current sensor circuit, may be loose connection, faulty current sensors, wrong sensors used.
03	
04	Over current condition has occurred during the auto tuning process.
12	Under voltage condition has been detected during the auto tuning process.

The other error codes are for internal diagnosis and debugging purpose.

4-4 Test operations

When finished with automatic tuning, test run the isolated motor, and make sure that there are no errors.

Use Digital Operation Panel mode to test run the motor. Initially set 10.0Hz and press "RUN" key to start the motor.

Check

- Did the motor run?
- Is the run direction correct? Check the wiring and operation if abnormal.
- Is the rotation smooth?

Select "REVERSE" direction in 'A305: Motor Direction' and Press "RUN" and confirm that the motor runs normal in reverse direction.

(Note) Do not carry out this step if a load, which cannot be run in reverse, is connected.

Press the “STOP” key and stop the motor. Now, again set the “FORWARD” direction in ‘A305: Motor Direction’ and increase the frequency to 50Hz.This completes the test operation with the operation panel.

After this, carry out the parameter settings and adjust the load operation to match the user's application.

Manual adjustment when torque accuracy is required (IM vector control mode)

In applications, which require high actual output torque accuracy in respect to the torque command (within ±10% of the rated output torque), the manual adjustments of Group-6 and Group-7 parameters may be required.

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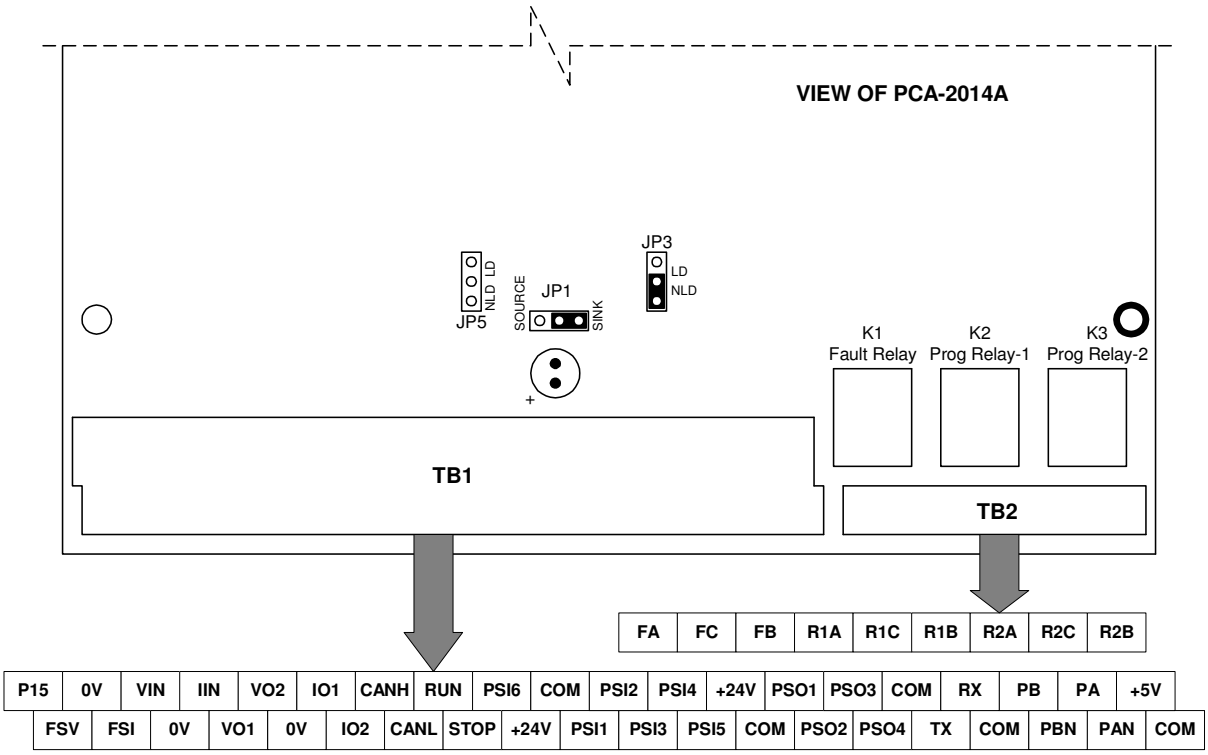
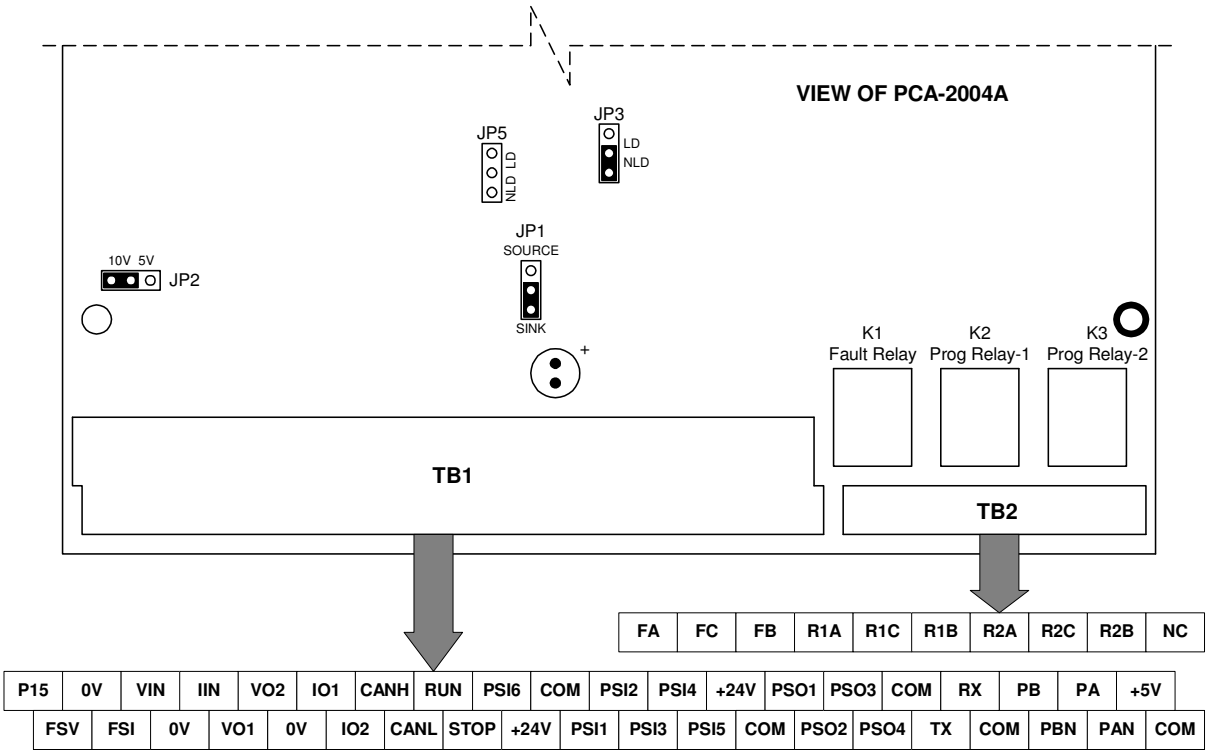
CHAPTER-5: CONTROL INPUT / OUTPUT TERMINALS

5-1 Input / output terminal functions of PCA-2014A and PCA-2004A (Control Unit)



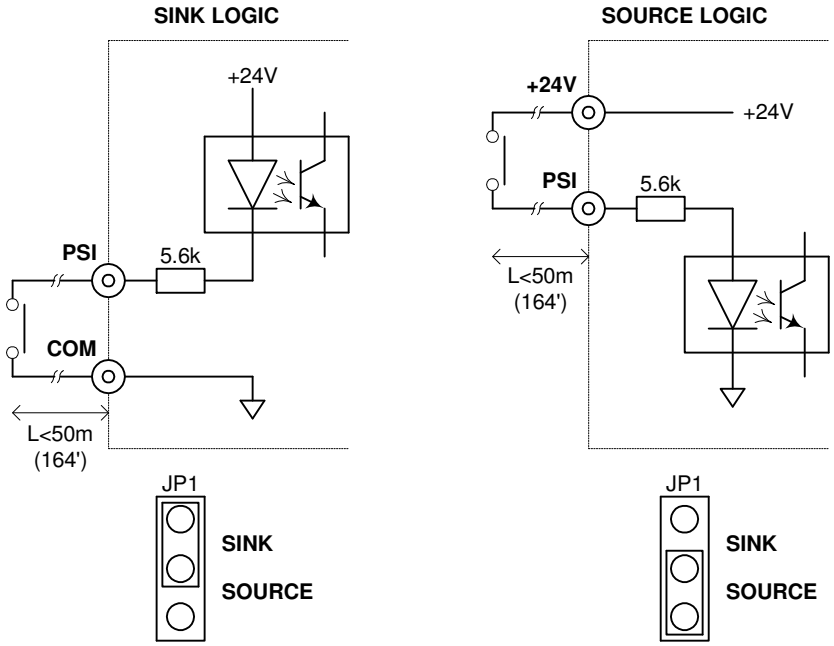


SYMBOL	NAME	USE
+24V	+24V source	This source is used for the Programmable Sequence Inputs. The logic for the Programmable Sequence Inputs can be changed to sink or source with the help of **JP1** on the control board.
COM		
RUN	RUN command	This is programmable sequence input and can be configured to different 35 functions using *C114*.
STOP	STOP command	This is programmable sequence input and can be configured to different 35 functions using *C115*.
PSI1-6	Programmable Sequence Inputs 1 ~ 6	These are programmable sequence inputs and can be configured to different 35 functions using *C101 ~ C106*.
PSO1-4	Programmable Sequence Outputs 1 ~ 4	These are programmable sequence outputs and can be configured to different 32 functions using *C107 ~ C110*.
P15	+15V source	This is a 10V source used when a frequency setter is connected to the FSV input circuit. The frequency setter to be used should be a variable resistor of 2k and 2W.
0V	Common	This is a common terminal for analog input signals.
FSV	Frequency Setting Voltage input	This is mainly used for setting the frequency (speed) input. A maximum frequency setting is available at 10V input. This setting is valid when FSV 0-10V, FSV 0-5V, FSV 10-0V or FSV 5-0V is selected as frequency reference input in *A106* or *D204* or torque reference input in *A108*. Also, this input can be configured as PID Reference input (*C603*) or PID Feedback input (*C604*) or Math Reference Input2 (*A702*) or Variable bias (*A706*) for math operation.
FSI	Frequency Setting Current input	This is mainly used for setting the frequency (speed) input. A maximum frequency setting is available at 20mA input. This setting is valid when FSI 0-20mA, FSI 4-20mA, FSI 20-0mA or FSI 20-4mA is selected as frequency reference input in *A106* or *D204* or torque reference input in *A108*. Also, this input can be configured as PID Reference input (*C603*) or PID Feedback input (*C604*) or Math Reference Input2 (*A702*) or Variable bias (*A706*) for math operation.
IIN	Current Input	This is mainly used for setting the frequency (speed) input. A maximum frequency setting is available at 20mA input. This setting is valid when IIN 4-20mA is selected as frequency reference input in *A106*. Also, this input can be configured as PID Reference input (*C603*) or PID Feedback input (*C604*) or Math Reference Input2 (*A702*) or Variable bias (*A706*) for math operation.
VIN	Voltage Input	This is mainly used for setting the frequency (speed) input. A maximum frequency setting is available at 10V input. This setting is valid when VIN 0-10V is selected as frequency reference input in *A106*. Also, this input can be configured as PID Reference input (*C603*) or PID Feedback input (*C604*) or Math Reference Input2 (*A702*) or Variable bias (*A706*) for math operation.
VO1	Vout-1	These are programmable analog voltage outputs 0-10V. In default condition, output frequency signal is assigned to VO1 and output current signal is assigned to VO2. Different seven internal signals can be assigned to these outputs using *C201* & *C202*.
VO2	Vout-2	
IO1	Iout-1	These are programmable analog current outputs 4-20mA. In default condition, motor power signal is assigned to IO1 and output voltage signal is assigned to IO2. Different seven internal signals can be assigned to these outputs using *C203* & *C204*.
IO2	Iout-2	
TX	DATA+	These two signals are for the two-wire RS-485 serial link. The protocol

RX	DATA-	used is Modbus-RTU.
PA	A-Phase Pulses	The A-phase positive pulse of encoder is applied at this terminal.
PAN		The A-phase negative pulse of encoder is applied at this terminal.
PB	B-Phase Pulses	The B-phase positive pulse of encoder is applied at this terminal.
PBN		The B-phase negative pulse of encoder is applied at this terminal.
+5V	+5V source	This is +5V source for the encoder. The encoder is required only in case of close loop control mode. Refer chapter-10 for detail on encoder specification.
FA	Programmable Fault Relay Contacts	This is programmable relay and its function is assigned to "Fault" condition in default. When a programmed condition occurs, the section FA-FC is closed and the section FB-FC is open. Select from different 32 options using *C113*.
FC		
FB		
R1A	Programmable Relay 1 contacts	This is programmable relay and its function is assigned to "Run" condition in default. When a programmed condition occurs, the section R1A-R1C is closed and the section R1B-R1C is open. Select from different 32 options using *C111*.
R1C		
R1B		
R2A	Programmable Relay 2 contacts	This is programmable relay and its function is not assigned to any internal signal in default. When any function is assigned using *C112* and the programmed condition occurs, the section R2A-R2C is closed and the section R2B-R2C is open. Select from different 24 options using *C112*.
R2C		
R2B		

The control circuit wiring is shown as under. The described precautions must be observed during wiring. Changing the jumper position **JP1** in PCA-2014A/PCA-2004A between "SINK" and "SOURCE" position can change the sequence input between sink logic and source logic. Open cover designated as "Control Unit" to access this jumper. ***The unit is shipped with sink logic.***

5-2 Programmable sequence input (PSI) wiring

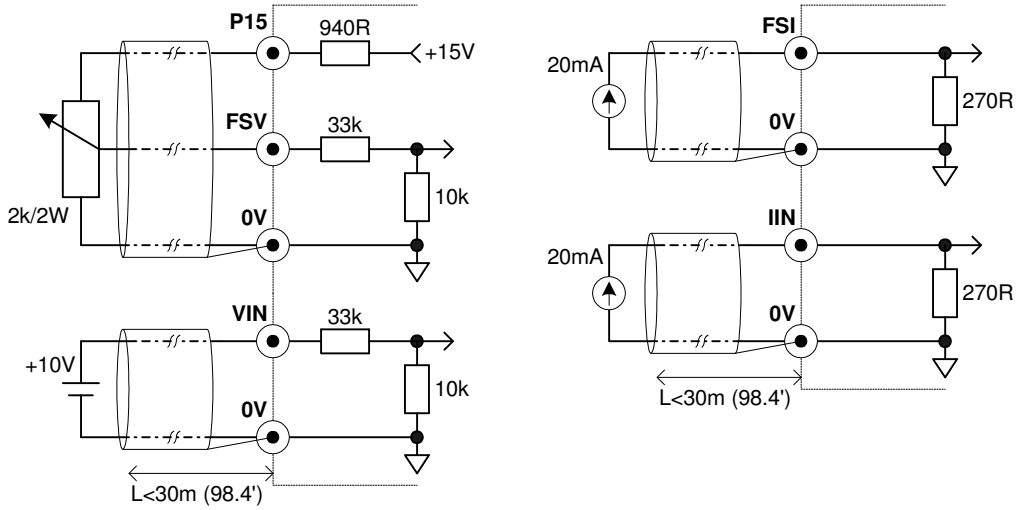


5

Precautions

1. Wiring must not be longer than 50meters (164').
2. Use minute current contact.
3. Do not connect to the analog input / output.
4. The sink / source logic can be changed with JP1 as shown in the above figure.

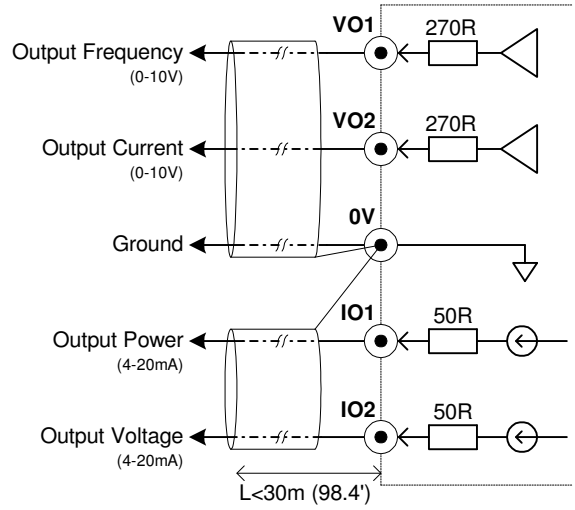
5-3 Programmable analog input (PAI) wiring



Precautions

1. Use 2kΩ / 2W rating potentiometer for the external variable resistor.
2. The maximum input rating of FSV /VIN is 0 to 10.5V.
3. Use a shielded wire shorter than 30meters (98.4') for the wiring.
4. For the shield connections, open the mate side, and connect to 0V terminal on TB1.
5. The maximum input rating for FSI / IIN is 0 to +21mA or 5.67V.
6. Do not connect to the sequence input.

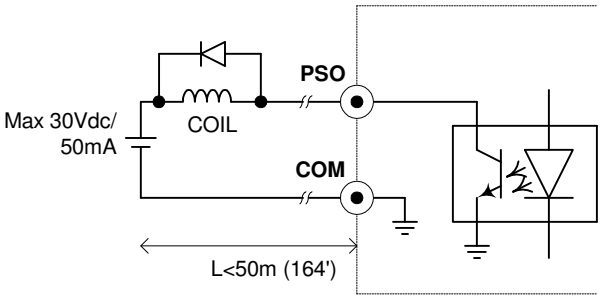
5-4 Programmable analog output (PAO) wiring



Precautions

1. Use 10V full-scale meter (impedance 10k or higher).
2. The maximum output current is 1mA for voltage output.
3. Use a shielded wire shorter than 30meters (98.4') for the wiring.
4. For the shield connections, open the mate side, and connect to 0V terminal on TB1.

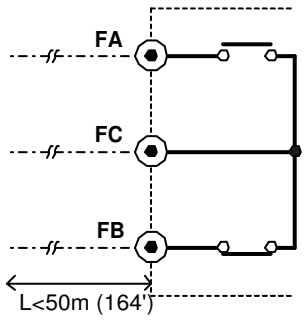
5-5 Programmable sequence output (Open Collector Type) wiring



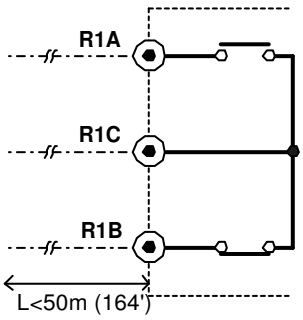
Precautions

1. To drive an L load, such as a coil, insert the flywheel diode shown in the drawing.
2. Keep the wiring length to 50meters (164') or less.
3. Use within the 30VDC, 50mA ratings range.

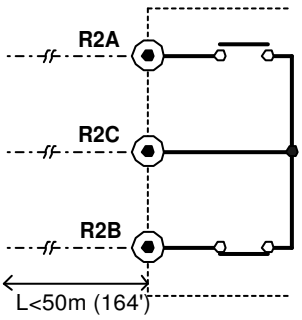
5-6 Programmable sequence output (Relay) wiring



PROGRAMMABLE FAULT RELAY



PROGRAMMABLE RELAY1



PROGRAMMABLE RELAY2

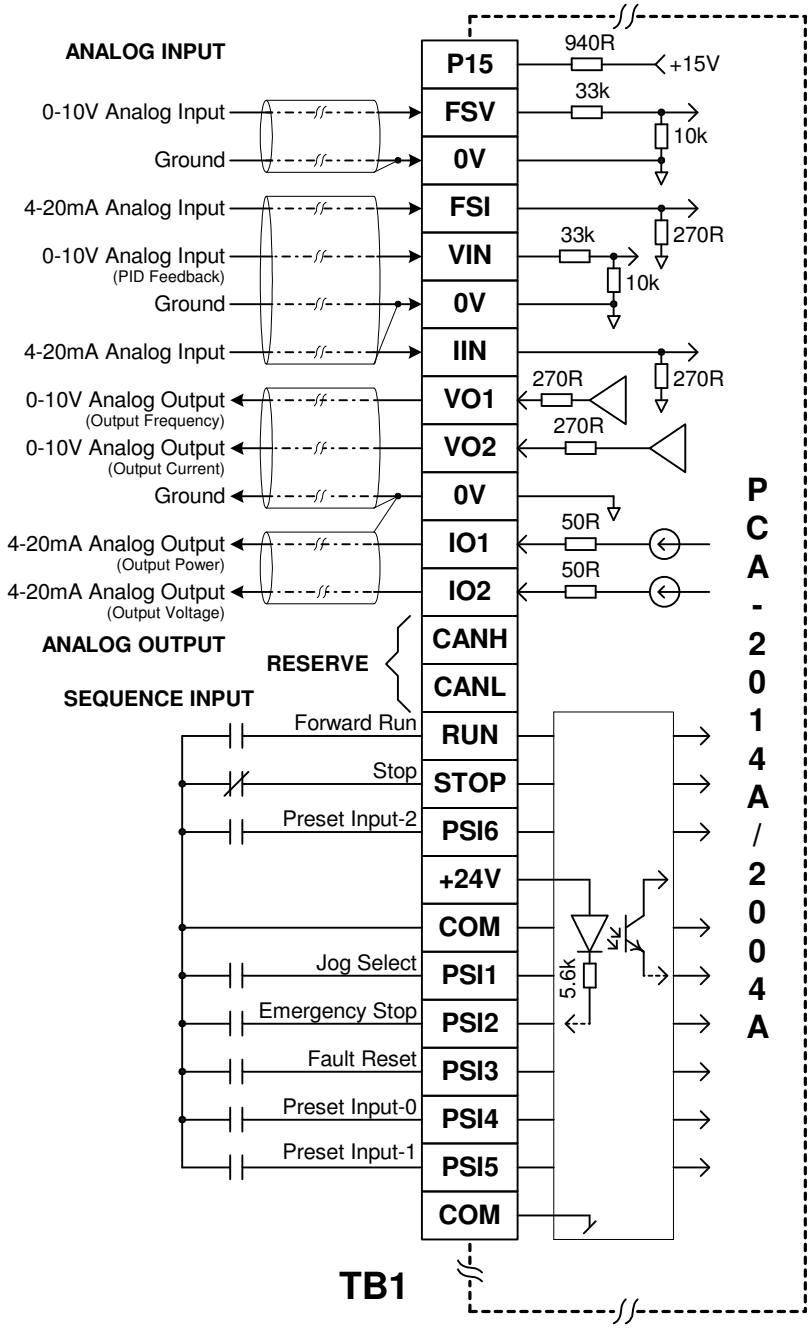
Precautions

1. Use within the rated range shown below.

Rated capacity (resistance load): 250VAC, 1A or 30VDC, 1A
Maximum Voltage: 250VAC
Max. Current: 1A
Switching capacity: 100VA / 100W

2. The wire must be shorter than 50meters (164').

5-7 Default function assignments to terminals

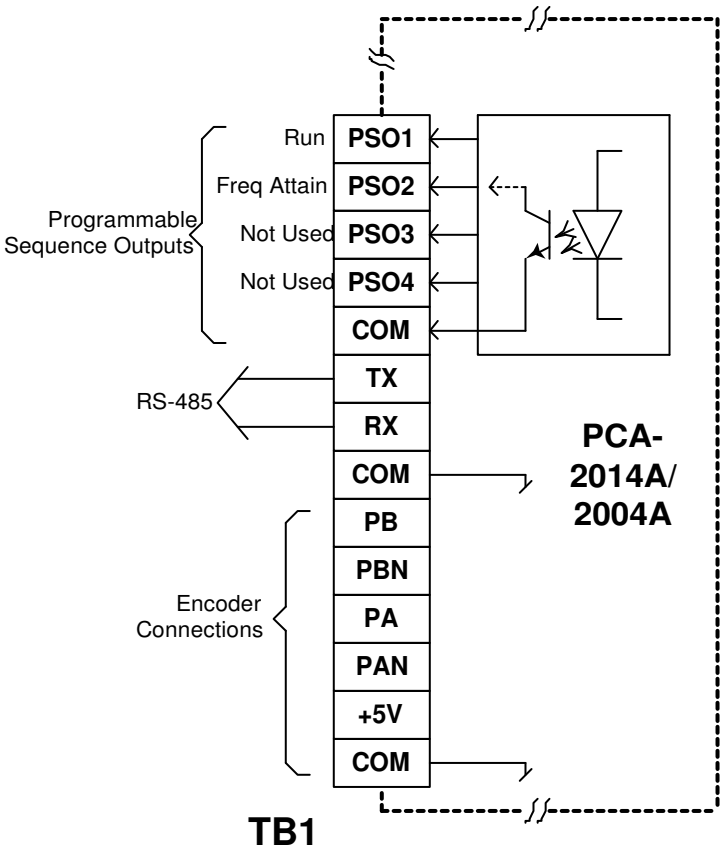


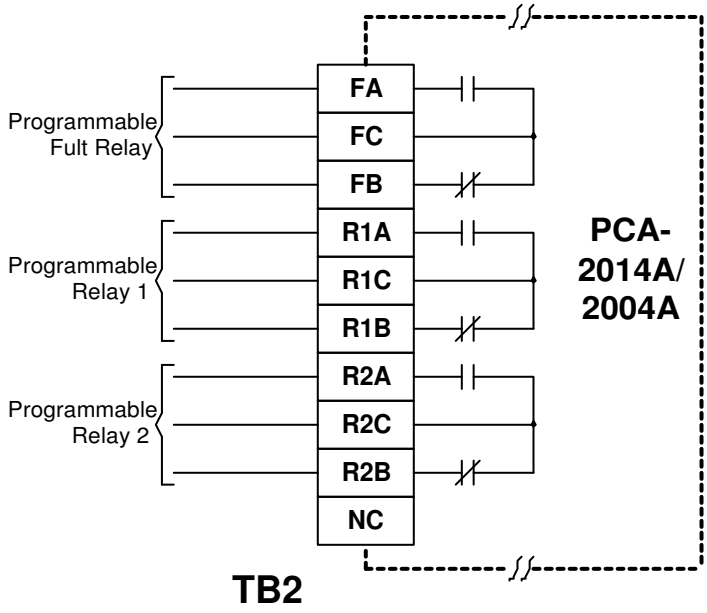
(Sink logic operation is considered for
programmable sequence inputs in this diagram)

Jumper Position

1. The equipment is shipped with sink logic (JP1 is kept on **Sink** position) for the programmable sequence inputs. To change the sink logic to source, change the jumper JP1 position to **Source**.

2. The equipment is shipped with JP3 in **NLD** position. This means the terminating resistors are not in picture. To insert the terminating resistors, keep the jumper to **LD** position.


Run
Freq Attain
Not Used
Not Used
Programmable
Sequence Outputs
PSO1
PSO2
PSO3
PSO4
COM
TX
RX
COM
RS-485
PB
PBN
PA
PAN
+5V
COM
Encoder
Connections
PCA-
2014A/
2004A
TB1


FA
FC
FB
R1A
R1C
R1B
R2A
R2C
R2B
NC
Programmable
Fult Relay
Programmable
Relay 1
Programmable
Relay 2
PCA-
2014A/
2004A
TB2

CHAPTER-6: PARAMETER SETTINGS & FUNCTIONS

MODE-M: Monitor Parameters

The monitor display various information like operating parameters, status of various signals, software version, falt history etc…

No.	Parameter	Unit	Res.	Description
GROUP-1				
M101	Output Frequency	Hz	0.01	It displays the output frequency. If the AC DRIVE is off, it will display zero.
M102	Motor Speed	rpm	1	It displays the motor speed or shaft rpm. If *A401*=1, 3, 5, 7: It displays the calculated motor speed or shaft rpm using line speed setting *A105* or *D205* and *M101*. If *A401*=2, 4, 6, 8: It displays the actual speed of motor shaft using encoder.
M103	Output Current	Amp	0.1	It will display the output current. If the AC DRIVE is OFF, it will display zero.
M104	Output Current	%L	1	The output current is displayed as % of motor rated current *B103*.
M105	Set Frequency	Hz*	0.01	The currently selected frequency setting value is displayed.
M106	Frequency Reference Input			The currently selected frequency setting input point in *A106* or *D204* will be displayed.
M107	Set Torque	%	0.1	The current value of torque setting is displayed in *vector control* mode.
M108	Torque Reference Input			The currently selected torque setting input point in *A108* will be displayed in *vector control* mode only.
M109	PID Reference		0.1	Displays the value of currently selected PID reference in the unit selected in *C614*.
M110	PID Feedback		0.1	Displays the value of currently selected PID feedback in the unit selected in *C614*.
M111	FSV Input Voltage ①	V	0.1	Display the analog input voltage at FSV.
M112	FSI Input Current ①	mA	0.1	Display the analog input current at FSI.
M113	VIN Input Voltage ①	V	0.1	Display the analog input voltage at VIN.
M114	IIN Input Current ①	mA	0.1	Display the analog input current at IIN.
M115	Output Current U ①	Amp	0.1	Display the Output current of U phase.
M116	Output Current V ①	Amp	0.1	Display the Output current of V phase.
M117	Output Current W ①	Amp	0.1	Display the Output current of W phase.
GROUP-2				
M201	Input Voltage Vry	Vac	1	Displays Input Vry Voltage. This may differ from the actual i/p voltage.
M202	Input Voltage Vyb	Vac	1	Displays Input Vyb Voltage. This may differ from the actual i/p voltage.
M203	Output Voltage	Vac	1	Displays output voltage command. The display may differ from the actual output voltage. It depends on the power supply voltage. It will display zero when AC DRIVE is OFF.
M204	DC Bus Voltage	Vdc	1	Displays the voltage of the DC bus in the main circuit.
M205	Output Power	KW	0.1	Displays the AC DRIVE output power.
M206	Energy Meter	KWH	0.1	Displays the energy consumed by the system in kWH.
M207	Energy Meter	MWH	1	Displays the energy consumed by the system in MWH.
M208	Heat sink Temperature	°C	1	Actual heat sink temperature is displayed.
M209	Torque Current	%	0.1	The torque current value is displayed using the motor rated current as 100% in *vector control* mode only.
M210	Excitation Current	%	0.1	The excitation current value is displayed using the motor rated current as 100% in *vector control* mode only.
M211	Heat sink Temperature	°F	1	Actual heat sink temperature is displayed in degree F.
① Available from Control version 7.02 and onwards.				

No.	Parameter	Unit	Res.	Description
M212	Energy Saved in kW	kWH	1	This parameter displays the saved energy using VFD in kWH.
M213	Energy Saved in MW	MWH	1	This parameter displays the saved energy using VFD in MWH.
M214	Hank Count		0.1	Displays the current hank count. The display is limited at a maximum of 6553.5. This is cleared to zero when power is turned off.
M215	Money Saved with VFD		1	This parameter displays the money saved with VFD in energy saving application. Select appropriate currency (*B113*) and energy cost (*B114*).
M216	Money Saved with VFD X1k		1	This parameter displays the money saved x 1000 with VFD in energy saving application. Select appropriate currency (*B113*) and energy cost (*B114*).
M217	Encoder Count		1	This parameter displays the Encoder count as per below formula. Encoder Count = (Encoder Pulses (*B109*)*Motor Speed (*M102*)*4* Speed loop time (*B601*)) / (60*1000)
GROUP-3				
M301	Total Conductivity Time	Hrs	1	The cumulative power on time after product shipment will be counted and displayed.
M302	Total Run Time	Hrs	1	The cumulative AC DRIVE run time after product shipment will be counted and displayed.
M303	Automatic Tuning display			The progression state of automatic tuning is displayed.
M304	Rated Current	A	0.1	This indicates the rated current of the AC DRIVE.
M305	Inverter Type	kW		This indicates the AC DRIVE type.
M306	Control Version			Indicates ROM version of DSP Control Board PCA-2014A/PCA-2004A.
M307	PSI-12345678 Status/ PSI-123456 Status ①			The ON/OFF state of various programmable sequence input will display.
M308	PSO-1234567 Status			The ON/OFF state of various programmable sequence o/p will display.
M309	Unit Serial Number			It displays the serial number of the unit.
M310	Ship Month			It displays the month of unit shipment.
M311	Ship Year			It displays the year of unit shipment.
M312	Display Version			Indicates ROM version of Display Board PCA-2012.
M313	PLC Display 1 ②		1	It displays the signed 16-bit register value from the In-built PLC.
M314	PLC Display 2 ②		1	It displays the signed 16-bit register value from the In-built PLC.
M315	PLC Display 3 ②		1	It displays the signed 16-bit register value from the In-built PLC.
M316	PLC Display 4 ②		1	It displays the signed 16-bit register value from the In-built PLC.
M317	PLC Display 5 ②		1	It displays the signed 16-bit register value from the In-built PLC.
M318	PLC Display 6 ②		1	It displays the signed 16-bit register value from the In-built PLC.
M319	PLC Display 7 ②		1	It displays the signed 16-bit register value from the In-built PLC.
M320	PLC Display 8 ②		1	It displays the signed 16-bit register value from the In-built PLC.
M321	PLC Display 9 ②		1	It displays the signed 16-bit register value from the In-built PLC.
M322	PLC Display 10 ②		1	It displays the signed 16-bit register value from the In-built PLC.
M323	PLC Flag status 0-7 ②		1	It displays the status of the PLC flag.

① Parameter ***M307***, Control version 7.02 and onwards show 8 PSI Status and Control version 3.17 and onwards show 6 PSI Status.

② Available in control version 7.02 and onwards.

No.	Parameter	Unit	Res.	Description
GROUP-4: FAULT HISTORY				
FLT-1	Fault 1			Most recent ten faults with DC bus voltage, frequency, current, temperature, input voltage, energy meter and conduction time values at the time of fault will be displayed. Fault 1 indicates latest fault while successive faults give past faults in descending order.
FLT-2	Fault 2			
FLT-3	Fault 3			
FLT-4	Fault 4			
FLT-5	Fault 5			
FLT-6	Fault 6			
FLT-7	Fault 7			
FLT-8	Fault 8			
FLT-9	Fault 9			
FLT10	Fault 10			
GROUP-5: CONTACT				
This provides the manufacturers contact information.				
Amtech Electronics (India) Limited. E-6, Electronics Zone GIDC, Gandhinagar Gujarat, INDIA Pin: 382028 Ph: +9179 23289101 Fax: +9179 23289111 info@amtechelectronics .com www.amtechelectronics.com				Amtech Drives, Inc 3852, Oakcliff Industrial Court Doraville, Georgia - 30340, USA Ph: +1 770 469 5240 Fax: +1 678 894 4043 info@amtechdrives .com www.amtechdrives.com
GROUP-6 ①				
M601	Output Current U1	Amp	0.1	Display the Output Current of U1 phase of Inverter Unit 1.
M602	Output Current V1	Amp	0.1	Display the Output Current of V1 phase of Inverter Unit 1.
M603	Output Current W1	Amp	0.1	Display the Output Current of W1 phase of Inverter Unit 1.
M604	Output Current1	Amp	0.1	Display the Output Current of Inverter Unit 1.
M605	Output Current U2	Amp	0.1	Display the Output Current of U2 phase of Inverter Unit 2.
M606	Output Current V2	Amp	0.1	Display the Output Current of V2 phase of Inverter Unit 2.
M607	Output Current W2	Amp	0.1	Display the Output Current of W2 phase of Inverter Unit 2.
M608	Output Current2	Amp	0.1	Display the Output Current of Inverter Unit 2.
M609	Output Current U3	Amp	0.1	Display the Output Current of U3 phase of Inverter Unit 3.
M610	Output Current V3	Amp	0.1	Display the Output Current of V3 phase of Inverter Unit 3.
M611	Output Current W3	Amp	0.1	Display the Output Current of W3 phase of Inverter Unit 3.
M612	Output Current3	Amp	0.1	Display the Output Current of Inverter Unit 3.
M613	Output Current U4	Amp	0.1	Display the Output Current of U4 phase of Inverter Unit 4.
M614	Output Current V4	Amp	0.1	Display the Output Current of V4 phase of Inverter Unit 4.
M615	Output Current W4	Amp	0.1	Display the Output Current of W4 phase of Inverter Unit 4.
M616	Output Current4	Amp	0.1	Display the Output Current of Inverter Unit 4.
M617	Output Current U5	Amp	0.1	Display the Output Current of U5 phase of Inverter Unit 5.
M618	Output Current V5	Amp	0.1	Display the Output Current of V5 phase of Inverter Unit 5.
M619	Output Current W5	Amp	0.1	Display the Output Current of W5 phase of Inverter Unit 5.
M620	Output Current5	Amp	0.1	Display the Output Current of Inverter Unit 5.
① Group 6 Parameters are available in control version 7.05 and onwards.				

No.	Parameter	Unit	Res.	Description
GROUP-7 ①				
M701	Control Version PI		0.01	Indicate ROM version of DSP Based interface board PCA-2013A for parallel inverter.
M702	Temperature IU-2	°C	1	Actual heat sink temperature of Inverter Unit 2 is displayed.
M703	Temperature IU-3	°C	1	Actual heat sink temperature of Inverter Unit 3 is displayed.
M704	Temperature IU-4	°C	1	Actual heat sink temperature of Inverter Unit 4 is displayed.
M705	Temperature IU-5	°C	1	Actual heat sink temperature of Inverter Unit 5 is displayed.
M706	Temperature DU-1	°C	1	Actual heat sink temperature of Diode Unit 1 is displayed.
M707	Temperature DU-2	°C	1	Actual heat sink temperature of Diode Unit 2 is displayed.
M708	Temperature Panel-1	°C	1	Actual Inside temperature of Panel 1 is displayed.
M709	Temperature Panel-2	°C	1	Actual Inside temperature of Panel 2 is displayed.
M710	Driver Status			The ON/OFF state of driver fault status from inverter unit (IU) will display.
① Group 7 Parameters are available in control version 7.05 and onwards.				

WP: Indicates that this parameter is Write Protected during RUN condition.

MODE-A Parameters

No.	Parameter	Unit	Def	Min	Max	Res.	Description	WP
GROUP-1: FREQUENCY SETTING								
A101	Local Set Frequency	Hz	10.00	0.10	600.00	0.01	This is the frequency set from Digital Operation Panel (LCD Keypad Module).	
A102	Minimum Frequency	Hz	0.10	0.10	600.00	0.01	These two parameters are used to configure Minimum and Maximum Frequency of the AC DRIVE.	
A103	Maximum Frequency	Hz	50.00	0.10	600.00	0.01		
A104	Jog Frequency	Hz	5.00	0.10	600.00	0.01	This is frequency setting for jog input.	
A105	Line Speed Setting		1500	0	3000	1	RPM line speed display. The entered value will be displayed as motor speed in *M102* at 50Hz in open loop v/f mode. It will not have any effect in *vector control* modes.	
A106	Frequency Reference Input ①		1	1	18	1	This is used to select the speed reference. =1: Local =2: FSV 0-10V =3: FSI 4-20mA =4: FSV 0-5V =5: FSI 0-20mA =6: FSV 10-0V =7: FSI 20-4mA =8: FSV 5-0V =9: FSI 20-0mA =10: Static pot =11: Serial =12: PID Output =13: VIN 0-10V =14: IIN 4-20mA =15: PLC A-O/P 1 =16: PLC A-O/P 2 =17: PLC A-O/P 3 =18: PLC A-O/P 4	
A107	Local Set Torque	%	0.0	-200.0	200.0	0.1	This is set torque from the operation panel in *vector control* mode.	
A108	Torque Reference Input ②		1	1	18	1	This is used to select the torque reference in *vector control* mode. =1: Local =2: FSV 0-10V =3: FSI 4-20mA =4: FSV 0-5V =5: FSI 0-20mA =6: FSV 10-0V =7: FSI 20-4mA =8: FSV 5-0V =9: FSI 20-0mA =10: Static pot =11: Serial =12: PID Output =13: VIN 0-10V =14: IIN 4-20mA =15: PLC A-O/P 1 =16: PLC A-O/P 2 =17: PLC A-O/P 3 =18: PLC A-O/P 4	
A109	Extended Parameter		0	0	1	1	This will enable to display mode D, mode E, mode G, mode H and mode P. =0: Disable =1: Enable	
A110	Frequency Reference Select 1 ③		3	1	14	1	This is used to select the speed reference using Ref Select 0 & Ref Select 1 through PSI. Refer description for selection detail.	
A111	Frequency Reference Select 2 ③		10	1	14	1	=1:Local =2:FSV 0-10V =3:FSI 4-20mA =4:FSV 0-5V =5:FSI 0-20mA =6:FSV 10-0V =7:FSI 20-4mA =8:FSV 5-0V =9:FSI 20-mA =10:Static Pot =11:Serial =12:PID Output =13:Vin 0-10V =14:Iin 4-20mA	
A112	Frequency Reference Select 3 ③		11	1	14	1		
A113	Stop Frequency		1.00	0.1	600.00	0.01	During deceleration drive act as coast to stop at this frequency.	

① For parameter ***A106***, Control version 7.02 and onwards have 18 selectable options and Control version 3.17 and onwards have 14 selectable options.

② For parameter ***A108***, Control version 7.02 and onwards have 18 selectable options and Control version 3.17 and onwards have 11 selectable options.

③ For parameter ***A110, A111, A112*** Control version 7.04 and onwards.

No.	Parameter	Unit	Def	Min	Max	Res.	Description	WP
GROUP-2: ACCELERATION / DECELERATION TIME								
A201	Acceleration Time-1	Sec	10.0	0.1	6000.0	0.1	Time needed to change the output frequency from zero to maximum.	
A202	Deceleration Time-1	Sec	20.0	0.1	6000.0	0.1	Time needed to change the output frequency from maximum to zero.	
A203	Acceleration Time-2	Sec	10.0	0.1	6000.0	0.1	The acceleration time and deceleration time for the second ramp function.	
A204	Deceleration Time-2	Sec	20.0	0.1	6000.0	0.1		
A205	S-Curve Selection		0	0	1	1	This will enable the s-curve shape during acceleration /deceleration. =0: Disable =1: Enable	
A206	S-Curve Time-1	Sec	0.1	0.1	3000.0	0.1	The maximum value will depend on the currently selected ramp time.	
A207	S-Curve Time-2	Sec	0.1	0.1	3000.0	0.1	The maximum value will depend on the currently selected ramp time.	
A208	Current Limit Acceleration Time	Sec	10.0	0.5	6000.0	0.1	This is ramp up time during the stall current limit.	
A209	Current Limit Deceleration Time	Sec	5.0	0.5	6000.0	0.1	This is ramp down time during the stall current limit.	
A210	Acceleration Deceleration Multiplier		1	1	3	1	This is multiplier for the acceleration/ deceleration time related parameters A201~A207 and D206~D207. =1: x1 =2: x10 =3: x100	
GROUP-3: START / STOP SELECTION & DC BRAKING								
A301	Start Control		1	1	3	1	Select start location. =1: Local =2: Terminal =3: Serial	
A302	Maintained Start / Stop		0	0	1	0	When using terminal start/ stop facility, this parameter gives the choice of having maintained or momentary contacts for start or stop. =0: The start control maintained type =1: The start/ stop control momentary type.	
A303	Start Delay Time	Sec	0.0	0.0	10.0	0.1	The motor will be delayed from the run command by the set time. This is used for synchronization with peripheral machines such as mechanical brakes.	
A304	Stop Mode		0	0	1	1	Select the stop method. =0: Ramp down to stop =1: Coast to stop	
A305	Motor Direction		0	0	1	1	Select direction of motor rotation. =0: Forward =1: Reverse	
A306	DC Brake Start Frequency	Hz	1.50	0.10	50.00	0.01	It is a frequency at which DC braking is initiated during stop.	

No.	Parameter	Unit	Def	Min	Max	Res.	Description	WP
A307	DC Brake Current	%	50	15	150	1	Configure amount of current available for the DC braking when DC braking is used during stop.	
A308	DC Brake Time	Sec	0.0	0.0	25.0	0.1	It is amount of time that DC braking will be applied when stop command issued. To disable DC Braking operation set this parameter to zero.	
A309	Stall Current Limit Selection		1	1	2	1	Select stall current limit.. =1: Local =2: Terminal When local is selected, B301 will be effective. When terminal is selected, stall current limit is set by the 0-10V analog signal at Vin.	
GROUP-4: V/F CHARACTERISTICS								
A401	Control Mode ①		5	1	8	1	Sets the motor control mode of operation. =1: V/F Open loop Heavy duty Control =2: V/F Close-loop Heavy duty Control =3: Sensor-less Heavy duty Vector Control =4: Close-loop Heavy duty Vector Control =5: V/F Open loop Normal duty Control =6: V/F Close-loop Normal duty Control =7: Sensor-less Normal duty Vector Control =8: Close-loop Normal duty Vector Control	✓
A402	V/F Selection		1	1	3	1	Select the appropriate v/f curve. =1: Linear Curve =2: Square Curve =3: Custom setting	✓
A403	Base Frequency	%	100.0	5.0	100.0	0.1	This is output frequency at which the output voltage reaches to Base Voltage *A404* and than after remains constant. This is percentage of Motor Frequency *B104.*	✓
A404	Base Voltage	%	100.0	0.1	100.0	0.1	This is the maximum output voltage available at Base Frequency *A403*. This is percentage of Motor Voltage *B102.*	✓
A405	VF1 Frequency	%	25.0	10.0	100.0	0.1	These parameters are used to create the custom V/Hz profile. Three different points for the curve can be defined to get the profile suitable for the application. *A405 <= A406 <= A407* *A408 <= A409 <= A410.* *A405~A407* are percentage of *A403* and *A408~A410* are percentage of *A404.*	
A406	VF2 Frequency	%	50.0	10.0	100.0	0.1		
A407	VF3 Frequency	%	75.0	10.0	100.0	0.1		
A408	VF1 Voltage	%	25.0	0.1	100.0	0.1		
A409	VF2 Voltage	%	50.0	0.1	100.0	0.1		
A410	VF3 Voltage	%	75.0	0.1	100.0	0.1		
GROUP-5: TORQUE BOOST								
A501	Manual Torque Boost setting	%	0.0	0.0	20.0	0.1	When setting manually, set the boost voltage at 0Hz as a percentage in respect to the rated output voltage. When programmed to zero, it will be disabled.	
A502	Automatic Torque Boost Selection		0	1	1	1	When automatic torque boost is selected, the R1 drop compensation and slip compensation functions will be valid. =0: Disable =1: Enable	
A503	Slip Compensation	Hz	0.0	0.0	5.0	0.1	Set the motor's rated slip.	
			2.0				This default value is applicable for V/F Closed loop control mode only.	

No.	Parameter	Unit	Def	Min	Max	Res.	Description	WP
GROUP-6: PARAMETER SELECTION FOR NORMAL DISPLAY SCREEN								
A601	Norm Parameter 1		1	1	20	1	Select from this to display on normal screen.	
A602	Norm Parameter 2		5	1	20	1	=1: M101 Hz =2: M102 rpm =3: M103 Amp	
A603	Norm Parameter 3		3	1	20	1	=4: M104 %L =5: M105 Hz* =6: M109 PR	
A604	Norm Parameter 4		4	1	20	1	=7: M110 Fb =8: M201 Vry =9: M202 Vyb	
A605	Norm Parameter 5		8	1	20	1	=10: M203 Vo =11: M204 Vdc =12: M205 kW	
A606	Norm Parameter 6		11	1	20	1	=13: M206 kWh =14: M207MWh =15: M208 ºC	
A607	Norm Parameter 7		12	1	20	1	=16: M211 ºF =17:M217 Enc Cnt =18: M115 Amp Uph	
A608	Norm Parameter 8		15	1	20	1	=19: M116 Amp Vph =20: M117 Amp Wph	
GROUP-7: FREQ REFERENCE MATH OPERATIONS								
A701	Multiplier-A106		1.000	-10.000	10.000	0.001	This is a multiplier to the frequency reference selected in *A106*.	
A702	Math Reference Input2 ②		1	1	9	1	Select the second reference for the math operations. =1: Not Used =2: FSV 0-10V =3: FSI 4-20mA =4: VIN 0-10V =5: IIN 4-20mA =6: PLC A-O/P 1 =7: PLC A-O/P 2 =8: PLC A-O/P 3 =9: PLC A-O/P 4	
A703	Multiplier-A702		1.000	-10.000	10.000	0.001	This is a multiplier to the math reference input2 selected in *A702*.	
A704	Math Operator		1	1	3	1	Select the mathematical operation to be carried out between frequency reference selected in *A106* and math reference input2 selected in *A702*. =1: + Add =2: x Multiply =3: / Divide	
A705	Fix Bias	Hz	0.00	0.00	600.00	0.01	This is fixed bias added into the output after the math operation.	
A706	Variable Bias		1	1	6	1	This parameter can be used to add variable bias into the output after the math operation. Select the variable bias from the options given below. =1: Not Used =2: FSV 0-10V =3: FSI 4-20mA =4: VIN 0-10V =5: IIN 4-20mA =6: Static Pot	

① For parameter A401, Control version 7.02 and onwards have 8 options and Control version 3.17 and onwards have 5 options.

② For parameter A702, Control version 7.02 and onwards have 9 options and Control version 3.17 and onwards have 5 options.

MODE-B Parameters

No.	Parameter	Unit	Def	Min	Max	Res.	Description	WP
GROUP-1: MOTOR PARAMETERS								
B101	Rated Input Voltage	Vac	3	1	5	1	Select suitable rated input voltage from the below selections for 400V, 500V & 600V Series. =1: 380V =2: 400V =3: 415V =4: 440V =5: 460V	✓
			8	6	8		=6: 500V =7: 550V =8: 575V	
			11	9	11		=9: 600V =10: 660V =11: 690V	
B102	Motor Voltage	Vac	415	380	480	1	This is the Motor rated Voltage. Set the voltage mentioned on the motor nameplate. The setting value depends on the 400V, 500V or 600V Series model.	✓
			575	500	575			
			690	600	690			
B103	Motor Current	Amp	M304	0.3* M304	M304	0.1	Set the motor rated current from the motor nameplate. It can be set to 30% of the AC DRIVE rated current *M304*	
B104	Motor Frequency	Hz	50.0	30.0	600.0	0.1	Set the motor rated frequency from the motor nameplate.	
B105	Motor Speed	rpm	1500	1	36000	1	Set the motor rated RPM from the motor nameplate.	
B106	Motor Output Rating	kW	M305	0.1	1500.0	0.1	The motor's rated output at base speed is set.	
B107	Motor Poles		4	2	16	2	Insert the motor poles.	
B108	No Load Output Voltage	Vac	160	20	460	1	The terminal voltage at no load at the base speed is set.	
B109	Encoder Pulses	P/R	2500	60	10000	1	Set as per the encoder specification.	
B110	Carrier Frequency	kHz	5	2	10	1	This parameter sets the AC DRIVE carrier frequency.	
			4		6		For 315kW and higher models in 400V series and for all models of 500V/600V series.	
B111	DTC Gain		70	0	255	1	This is gain for the dead time compensation. Adjust incase of motor hunting.	
B112	kW without VFD	kW	M305	0	65535	1	Enter previous kW consumption without VFD. This parameter is used to calculate the energy saving using VFD.	
B113	Currency Selection		1	1	3	1	Select your currency for the energy cost. =1: INR =2: USD =3: EURO	
B114	Energy Cost		4.000	0.000	65.535	0.001	Enter here the cost per kW in selected currency.	
B115	Local Set Voltage	%	100.0	5.0	100.0	0.1	This is the set voltage when the inverter is used as variable voltage source application and voltage reference in B116 is selected as *Local.* Set as % of motor voltage *B103.*	
B116	Output Voltage Reference Selection		1	1	3	1	Select the set reference for the output voltage, when inverter is used as variable voltage source application. =1: Local =2: FSV 0-10V =3: FSI 4-20mA	

No.	Parameter	Unit	Def	Min	Max	Res.	Description	WP
B117	Encoder Polarity		0	0	1	1	This is used to select Encoder polarity. =0:Forward =1:Reverse	✓
GROUP-2: MOTOR CONSTANTS								
B201	Automatic Tuning Selection		1	1	5	1	The Automatic tuning mode is selected. =1: Disable Auto-tuning =2: Adjustment for V/F Control =3: Adjustment for V/F Close-loop Control =4: Adjustment for Sensor-less Vector Control =5: Adjustment for Close-loop Vector Control	✓
B202	R1: Primary Resistance (Mantissa)	mΩ	Inv rating	0.100	9.999	0.001	The motor circuit constant is set. This combination means below} R2' = 1.000 x (10) exp 0 [mΩ]. This is exponent section.	
B203	R1: Primary Resistance (Exponent)		Inv rating	-3	4	1	This is exponent section of the entered value for Primary Resistance of motor.	
B204	R2': Secondary Resistance (Mantissa)	mΩ	1.000	0.100	9.999	0.001	This is mantissa section of the entered value for Secondary Resistance of motor.	
B205	R2': Secondary Resistance (Exponent)		0	-3	4	1	This is exponent section of the entered value for Secondary Resistance of motor.	
B206	L: Leakage Inductance (Mantissa)	mH	1.000	0.100	9.999	0.001	This is mantissa section of the entered value for Leakage Inductance of motor.	
B207	L: Leakage Inductance (Exponent)		0	-3	4	1	This is exponent section of the entered value for Leakage Inductance of motor.	
B208	M': Excitation Inductance (Mantissa)	mH	1.000	0.100	9.999	0.001	This is mantissa section of the entered value for Excitation Inductance.	
B209	M': Excitation Inductance (Exponent)		0	-3	4	1	This is exponent section of the entered value for Excitation Inductance.	
B210	Rm: Iron Loss Resistance (Mantissa)	mΩ	1.000	0.100	9.999	0.001	This is mantissa section of the entered value for Iron Loss Resistance.	
B211	Rm: Iron Loss Resistance (Exponent)		0	-3	5	1	This is exponent section of the entered value for Iron Loss Resistance.	
GROUP-3: PROTECTION PARAMETERS								
B301	Stall Current Limit	%	150.0	0.0	200.0	0.1	Set the current value as a percentage of motor rated current for normal running condition.	
B302	Adjustable Over Current Level	%	300	50	300	1	Set the upper current level as a percentage of motor rated current. When set to 300%, this feature is disabled.	
B303	Acceleration Current Limit	%	150	50	200	1	Set the upper current limit as a percentage of motor rated current for Acceleration.	
B304	Under Current Level	%	0	0	90	1	Set the lower current level as a percentage of motor rated current for running condition.	

① Available in control version 3.17 and onwards.

No.	Parameter	Unit	Def	Min	Max	Res.	Description	WP
B305	Overload Setting	%	105	50	105	1	This is reference for timed overload characteristic. The inverse time characteristics will change with change in *B305.* *This overload setting for Heavy Duty.*	
			100	50	100		*This overload setting for Normal Duty.*	
B306	Earth Fault detection Level	%	50	0	100	1	This parameter sets the earth fault detection level.	
B307	DC Bus Voltage Control		1	1	3	1	When enabled, it will prevent the overvoltage during RUN condition. =1: Disable =2: Frequency Increase =3: Stop Deceleration	
B308	Reverse Direction Lock		0	0	1	1	Set this to prevent unintentional reverse direction operation. When enabled, ensure that forward direction is selected in *A305* (or at terminal). *The AC DRIVE will not start otherwise.* =0: Disable =1: Enable	✓
B309	Parameter Lock		0	0	9999	1	User selectable 4-digit password to prevent unintentional parameter changes from the digital operation panel.	
B310	Change Password		0	0	9999	1	User can change the 4-digit user password for parameter lock.	
B311	Default Value Load		0	0	111	1	The current active parameters will be saved to non-volatile memory.	
					222		The saved parameters will be fetched from memory and now the drive will respond to these parameters.	✓
					333		All default values will be loaded excluding C205 to C218 and B202 to B211 as per 60Hz/460V (US standard).	✓
					444		All default values will be loaded excluding C205 to C218 and B202 to B211 as per 50Hz/415V.	✓
					555		When set to 555, the fault history buffer is cleared. No previous fault codes and related parameters will be available.	
					666		All the user parameters will be set to default including C205 to C218 and B202 to B211 as per 50Hz/415V.	✓
					777		All the PLC parameters will be set to default.	✓
Note: *The value entered in this parameter will not be memorized. It correct value is entered, appropriate action will be taken and "00" will be displayed. If incorrect value is entered, no action will be taken and "00" will be displayed.*								
B312	0Hz Overload Setting	%	105	0	B313	1	For the self-cooling type motor, when operating at low speed, set these parameters to meet the motor characteristics.	
B313	0.7*BF Overload Setting	%	105	0	B305	1		
B314	Unbalance Level (Output current)	%	30	0	100	1	Set the unbalance current level for the output. When the current unbalance exceeds the set level, the unit will trip. Set to 0% to disable the function.	

No.	Parameter	Unit	Def	Min	Max	Res.	Description	WP
B315	Copy Parameter Set ①		0	0	5	1	Copy all parameters from control side to the Display EEPROM. User can copy 3 sets of all parameters. =0:Ent Copy Set =4:Copy Set 4 =1:Copy Set 1 =5:Copy Set 5 =2:Copy Set 2 =3:Copy Set 3	✓
B316	Paste Parameter Set ①		0	0	5	1	Paste all parameters from Display EEPROM to the control side. User can paste 3 sets of all parameters. =0:Ent Paste Set =4: Paste Set 4 =1: Paste Set 1 =5: Paste Set 5 =2: Paste Set 2 =3: Paste Set 3	✓
GROUP-4: PRESET SPEED								
B401	Preset Speed-1	Hz	10.00	0.10	600.00	0.01	These preset speeds can be selected by programmable sequence inputs and one can set the frequencies as per requirement.	
B402	Preset Speed-2	Hz	15.00	0.10	600.00	0.01		
B403	Preset Speed-3	Hz	20.00	0.10	600.00	0.01		
B404	Preset Speed-4	Hz	25.00	0.10	600.00	0.01		
B405	Preset Speed-5	Hz	30.00	0.10	600.00	0.01		
B406	Preset Speed-6	Hz	40.00	0.10	600.00	0.01		
B407	Preset Speed-7	Hz	50.00	0.10	600.00	0.01		
GROUP-5: SKIP FREQUENCY								
B501	Skip Frequency-1	Hz	0.10	0.10	600.00	0.01	Sets the skip frequencies and the avoidance band for the each frequency.	
B502	Skip Frequency-2	Hz	0.10	0.10	600.00	0.01		
B503	Skip Frequency-3	Hz	0.10	0.10	600.00	0.01		
B504	Skip Band	Hz	0.00	0.00	10.00	0.01		
GROUP-6: VECTOR CONTROL CONSTANTS-1								
B601	Speed Loop Time	ms	10	1	40	1	Speed control repetition time	
B602	ASR P- Action Control	%	50	1	400	1	ASR proportional output control factor	
B603	ASR Dead Band	%	0.0	0.0	100.0	0.1	The non sensitive rang of ASR input	
B604	Speed LPF Time Constant	ms	0.0	0.0	1000.0	0.1	Speed feedback low pass filter Time constant	
B605	ASR Kp		20	1	100	1	Proportional gain for speed regulator	
B606	ASR Ti	Sec	0.8	0.01	10.00	0.01	Integral time constant for speed regulator	
B607	ASR Drive Torque Limit	%	100.0	50.0	200.0	0.1	Drive torque limit	
B608	ASR Regenerative Torque Limit	%	100.0	0.0	200.0	0.1	Regenerative torque limit	
B609	Speed Estimation Kp		0.075	0.001	30.000	0.001	Gain for speed estimation	
B610	Speed Estimation Ti	Sec	0.40	0.01	10.00	0.01	Time constant for speed estimation	

① Available in control version 7.02 and onwards.

No.	Parameter	Unit	Def	Min	Max	Res.	Description	WP
B611	Over Speed Protection Level	%	105.0	20.0	200.0	0.1	This is the over speed protection level. When the detection speed is equal to or higher than the set level for 1000msec, the unit will trip in over speed fault.	
B612	Speed Deviation Level	%	10.0	10.0	100.0	0.1	This is the speed deviation level. A speed deviation error occurs when the speed command and speed detection difference is higher than the set level for 1000msec.	
B613	Machine Time Constant	mS	500	0	30000	1	The time to accelerate the motor and load's torque inertia to the base speed at the rated torque is set.	
B614	Acceleration Machine Bias	%	0.0	0.0	100.0	0.1	This is add fixed bias in speed PID output during acceleration.	
B615	Deceleration Machine Bias	%	0.0	0.0	100.0	0.1	This is add fixed bias in speed PID output during deceleration.	
GROUP-7: VECTOR CONTROL CONSTANTS-2								
B701	Torque Mode Selection		0	0	1	1	This parameter will select the torque control mode. =0: Disable =1: Enable	
B702	Excitation Current Reference	%	30	15	65	1	Excitation Current Set value	
B703	Torque LPF Time constant	ms	0.0	0.0	1000.0	0.1	Torque reference low pass filter Time constant	
B704	ACR Kp		0.45	0.01	100.00	0.01	Proportional gain for speed regulator	
B705	ACR Ti	ms	0.40	0.01	300.00	0.01	Integral time constant for speed regulator	
B706	ACR Q Upper Lmt	%	100.0	0.0	150.0	0.1	ACR Q-Controller output upper limit	
B707	ACR Q Lower Lmt	%	100.0	0.0	150.0	0.1	ACR Q-Controller output lower limit	
B708	ACR D Upper Lmt	%	100.0	0.0	150.0	0.1	ACR D-Controller output upper limit	
B709	ACR D Lower Lmt	%	100.0	0.0	150.0	0.1	ACR D-controller output lower limit	
B710	Torque reference Polarity	%	0	0	1	1	This is used to select Torque reference polarity. =0: Unipolar =1: Bipolar	✓

MODE-C Parameters

No.	Parameter	Unit	Def	Min	Max	Res	Description	WP
GROUP-1: PROGRAMMABLE INPUT/OUTPUT								
C101	PSI-1 ①		2	1	36	1	The different options are as under.	
C102	PSI-2 ①		10	1	36	1	=1: Not Used =2: Jog Select =3: Ramp Select =4: Preset i/p-0 =5: Preset i/p-1 =6: Preset i/p-2 =7: Freq Increase =8: Freq Decrease =9: Aux Drive =10: Emergncy Stop-NO =11: Fault Reset =12: Ext Fault-NO =13: Reverse =14: Terminal =15: Ref Select 0 =16: Ref Select 1 =17: PR Step Skip =18: PR Step Hold =19: PR/RSF Reset =20: PID Bypass =21: PID Disable =22: Emergncy Stop-NC =23: Ext Fault-NC =24: Run =25: Stop =26: Drive Enable-NO =27: Drive Enable-NC =28: PLC input 1 =29: PLC input 2 =30: PLC input 3 =31: PLC input 4 =32: PLC input 5 =33: PLC input 6 =34: PLC input 7 =35: PLC input 8 =36: Torque Mode	
C103	PSI-3 ①		11	1	36	1		
C104	PSI-4 ①		4	1	36	1		
C105	PSI-5 ①		5	1	36	1		
C106	PSI-6 ①		6	1	36	1		
C107	PSO-1 ②		2	1	34	1	The different options are as under.	
C108	PSO-2 ②		6	1	34	1	=1: Not Used =2: Run =3: Local =4: Reverse Run =5: I-Detection =6: Freq Attain =7: Speed Detect1 =8: Speed Detect2 =9: Acceleration =10: Deceleration =11: Aux Drive =12: Timer Output =13: Zero Speed =14: Fault Alarm =15: PID Up Limit =16: PID Lo Limit =17: Temp Alarm =18: Ready =19: Pump-1 =20: Pump-2 =21: Pump-3 =22: Pump-4 =23: Doff-End Alarm =24: Sleep Mode =25: Fault =26: PLC Output 1 =27: PLC Output 2 =28: PLC Output 3 =29: PLC Output 4 =30: PLC Output 5 =31: PLC Output 6 =32: PLC Output 7 =33: PID F/B ULmt =34: PID F/B LLmt	
C109	PSO-3 ②		1	1	34	1		
C110	PSO-4 ②		1	1	34	1		
C111	Programmable Relay1 ②		2	1	34	1		
C112	Programmable Relay2 ②		1	1	34	1		
C113	Programmable Fault Relay ②		25	1	34	1		
C114	PSI-RUN ①		24	1	36	1	The different options are same as PSI option.	
C115	PSI-STOP ①		25	1	36	1		
GROUP-2: ANALOG OUTPUT SELECTION								
C201	Vout-1 ③		1	1	15	1	This configures the function of analog output.	
C202	Vout-2 ③		2	1	15	1	=1: Output Frequency =2: Output Current =3: Output Power =4: Output Voltage =5: DC Bus Volt =6: PID Output =7: Heat sink Temp =8: PLC A-O/P 1 =9: PLC A-O/P 2 =10: PLC A-O/P 3 =11: PLC A-O/P 4 =12: Uni Trq Cur =13: Excitation Current =14: Set Frequency =15: Bi Trq Cur	
C203	Iout-1 ③		3	1	15	1		
C204	Iout-2 ③		4	1	15	1		
C205	Vout-1 Gain		0.985	0.100	2.500	0.001	This is gain setting for the VO1 analog output.	

① Control version 7.02 and onwards have 35 options and Control version 3.17 and onwards have 23 options.
② Control version 7.02 and onwards have 32 options and Control version 3.17 and onwards have 24 options.
③ Control version 7.04 and onwards have 14 options and Control version 3.17 and onwards have 7 options.

No.	Parameter	Unit	Def	Min	Max	Res	Description	WP
C206	Vout-2 Gain		0.985	0.100	2.500	0.001	This is gain setting for the VO2 analog output.	
C207	Iout-1 Gain		0.995	0.100	2.500	0.001	This is gain setting for the IO1 analog output.	
C208	Iout-1 Bias		980	100	1500	1	This is bias setting for the IO1 analog output.	
C209	Iout-2 Gain		0.995	0.100	2.500	0.001	This is gain setting for the IO2 analog output.	
C210	Iout-2 Bias		980	100	1500	1	This is bias setting for the IO2 analog output.	
C211	FSV Gain		1.250	0.100	1.500	0.001	This is gain setting for the FSV analog input.	
C212	FSV Bias		0	0	1000	1	This is bias setting for the FSV analog input.	
C213	FSI Gain		1.050	0.100	1.500	0.001	This is gain setting for the FSI analog input.	
C214	FSI Bias		705	0	1000	1	This is bias setting for the FSI analog input.	
C215	VIN Gain		1.085	0.100	1.500	0.001	This is gain setting for the VIN analog input.	
C216	VIN Bias		0	0	1000	1	This is bias setting for the VIN analog input.	
C217	IIN Gain		1.050	0.100	1.500	0.001	This is gain setting for the IIN analog input.	
C218	IIN Bias		705	0	1000	1	This is bias setting for the IIN analog input.	
C219	FSV/FSI Time Constant	mS	100	0	1000	1	This parameter set the filter time constant for the FSV and FSI analog inputs.	
C220	VIN/IIN Time Constant	mS	100	0	1000	1	This parameter set the filter time constant for the VIN and IIN analog inputs.	
C221	Vout-1 Bias ①		85	0	1000	1	This is bias setting for analog output voltage VO1.	
C222	Vout-2 Bias ①		85	0	1000	1	This is bias setting for analog output voltage VO2.	
GROUP-3: STATUS OUTPUT DETECTION LEVEL								
C301	Frequency Attainment Detection Width	%	1.0	0.0	20.0	0.1	The attained frequency output (*Freq Attain*) operation width is set.	
C302	I-Detection Level (current detection)	%	100.0	5.0	200.0	0.1	The current detection (*I-Detection*) operation level is set. Set with a percentage of the rated current (*B103*). The hysteresis will occur with set value in parameter *C314* for the I-Detection operation.	
C303	Speed Detection Level-1	%	95.0	1.0	105.0	0.1	The speed detection operation level is set. Set with a percentage to the max frequency *A103*. The output frequency or the motor speed will be the comparison target. A 1% hysteresis will occur with speed detection operation.	
C304	Speed Detection Level-2	%	50.0	1.0	105.0	0.1		
C305	Zero Speed Detection Level	%	1.0	0.0	50.0	0.1	The Zero speed detection operation level is set. Set with a percentage to the max frequency (*A103*). The output frequency or the motor speed will be the comparison target. A 1% hysteresis will occur with zero speed operation.	
C306	4-20mA Reference Loss		2	1	7	1	This parameter configures the AC DRIVE's response to a failure of 4-20mA Frequency reference input signal. =1: No action at fault detection =2: Minor fault alarm & run at minimum speed =3: Minor fault alarm & run at maximum speed =4: Minor fault alarm & run at set speed =5: Minor fault alarm & run at preset speed-1 =6: Fault, ramp down to stop =7: Fault, coast to stop	
① Available in control version 7.02 and onwards.								

No.	Parameter	Unit	Def	Min	Max	Res	Description	WP
C307	Output Phase Loss selection		1	0	1	1	Output open-phase is detected if one phase current is <5% and other two phase currents are >70% of motor rated current for five cycles, when this protection is enabled. =0: Disable =1: Enable	
C308	Timer Output control Selection		0	0	1	1	Set the ON/OFF control for the timer output. =0: ON only when AC DRIVE is ON =1: ON whenever power is ON	
C309	Timer output Off Delay time	Sec	60	0	3000	1	Set the time in seconds to delay turning OFF the timer output after the AC DRIVE OFF command is received.	
C310	Temperature Control selection		1	0	1	1	This parameter controls the automatic change of the carrier frequency in case of temperature rise above the predefined level.	
C311	Temperature Alarm Level	°C	82	0	95	1	This is temperature alarm level set point. Whenever the heat sink temperature exceeds the set value, the *Temp Alarm* output will be set. Hysteresis of 2°C hysteresis will occur with temperature alarm.	
C312	In-built PLC Selection ①		0	0	1	1	By Using this parameter In-built PLC function can Enable or Disable.	
	Input Phase Check ②		1	0	1	1	The input phase sequence check can be disabled using this parameter.	
C313	Static pot options		1	1	5	1	This parameter provides selection of the static pot speed at power up. =1: Last speed =2: Min frequency (*A102*) =3: Max frequency (*A103*) =4: A101 Set frequency =5: B401 Preset speed-1	
C314	I-Detection Hysteresis Level	%	5	1	20	1	This parameter sets the hysteresis level for I-Detection operation	
GROUP-4: SERIAL COMMUNICATION								
C401	Baud Rate	bps	4	1	6	1	Sets the baud rate for the serial communication. =1: 1200 bps =2: 2400 bps =3: 4800 bps =4: 9600 bps =5: 19200 bps =6: 38400 bps	
C402	Station Number		1	1	247	1	Sets the station number (address).	
C403	Parity		1	1	3	1	Setting the parity requirement for the communication =1: No Parity =2: Odd parity =3: Even Parity	
C404	Response Time	Sec	0.01	0.00	2.00	0.01	Set the minimum time from receiving the command to returning an answer.	
C405	Operation Panel Communication Loss Selection		0	0	1	1	Enable or disable the operation panel communication loss fault. If enabled, AC DRIVE will generate fault if it does not receive any response from the operation panel within 100msec. =0: Disable =1: Enable	

① Available in control version 7.02 and onwards.
② Available in control version 3.17 and onwards.

No.	Parameter	Unit	Def	Min	Max	Res	Description	WP
GROUP-5: AUTO RESTART & SPEED SEARCH FUNCTION								
C501	No. Of Restart		0	0	10	1	Sets the number of restart for ten faults.	
C502	Restart Wait Time	Sec	5	1	30	1	Sets the wait time before auto restart.	
C503	Emergency Stop Mode		1	1	3	1	Set the stopping method for the emergency stop. =1: Coast to stop without fault output =2: Coast to stop with fault output =3: Ramp down to stop	
C504	Speed Search Selection		0	0	1	1	Enable or disable the speed Search operation. =0: Disable =1: Enable	
C505	Speed Search Current Limit	%	70	30	200	1	Sets the speed search operation current as a percentage, taking the AC DRIVE rated current as 100%. Not usually necessary to set. When restarting is not possible with the factory settings, reduce the value.	
C506	Speed Search Frequency Deceleration Time	Sec	2.00	0.01	30.00	0.01	This decides the frequency ramp down time from max frequency during speed search operation.	
C507	Speed Search Voltage Acceleration Time	Sec	2.0	0.1	10.0	0.1	This decides the output voltage ramp up time from zero to base voltage during speed search operation.	
C508	Speed Search Wait Time	Sec	2.0	0.0	20.0	0.1	The wait time after the output is cut off to when the speed search operation is started is set. Set the time to when the motor residual voltage is abated for this parameter. The search operation is delayed by the time set here.	
C509	PLCT Time	Sec	2.0	0	5.0	0.1	Set time interval to perform PLCT. When programmed to 0, the PLCT function will be disabled.	
C510	Speed Search Match Current Limit	%	100	30	200	1	Speed search match current limit function limit drive current when speed match with actual motor speed. Not usually necessary to set. When restarting is not possible with the factory settings, set the value.	
C511	Speed Search Match freq. gain		4.0	0.0	20.0	0.1	Set gain to Increase the frequency after speed detect for speed search function.	
GROUP-6: PID CONTROL SELECTION								
C601	PID Control Selection		0	1	1	1	Enable or disable the PID control action. =0: Disable =1: Enable	
C602	PID Polarity		1	0	1	1	This can be used to invert the PID output. =0: Negative =1: Positive	
C603	PID Reference Input ①		5	1	10	1	Decides the set input point for the PID. =1: FSV 0-10V =2: FSI 4-20mA =3: Vin 0-10V =4: Iin 4-20mA =5: Local =6: Serial =7: PLC A-O/P 1 =8: PLC A-O/P 2 =9: PLC A-O/P 3 =10: PLC A-O/P 4	

① Control version 7.02 and onwards, this parameter has 10 options and Control version 3.17 and onwards it has 6 options.

No.	Parameter	Unit	Def	Min	Max	Res	Description	WP	
C604	PID Feedback Input Selection ①		3	1	8	1	Decides the feedback input point for the PID. =1: FSV 0-10V =3: Vin 0-10V =5: PLC A-O/P 1 =7: PLC A-O/P 3	=2: FSI 4-20mA =4: Iin 4-20mA =6: PLC A-O/P 2 =8: PLC A-O/P 4	
C605	Proportional Gain		1.0	0.1	10.0	0.1	Sets the proportional gain for the PID controller.		
C606	Integral Time	Sec	1.0	0.1	100.0	0.1	Sets the Integral time for the PID controller.		
C607	Derivative Gain		0.00	0.00	1.00	0.01	Sets the Derivative gain for the PID controller.		
C608	PID deviation Upper Limit	%	100.0	50.0	100.0	0.1	Sets PID Deviation upper limit.		
C609	PID deviation Lower Limit	%	0.0	0.0	50.0	0.1	Sets PID Deviation lower limit.		
C610	PID Offset Adjustment	%	0.0	-100.0	100.0	0.1	Sets offset for output after PID control.		
C611	PID Reference Setting	%	50.0	1.0	6553.5	0.1	Set the reference value, if operational panel option is selected in parameter *C603*. The unit will be as per the selection in *C614*.		
C612	PID Display Scale – Max		100.0	0.0	6553.5	0.1	Use these parameters to scale the PID signal. This is used only for the display purpose and will not have any effect on operation. Unit display as per *C614*.		
C613	PID Display Scale – Min		0.0	0.0	6553.5	0.1			
C614	PID Display Unit Selection		1	1	8	1	Select the unit for the PID signal. =1: % =3: kg/cm^2 =5: ℉ =7: m^3/H	=2: PSI =4: ℃ =6: CFM =8: LPM	
C615	Sleep Mode Selection		0	0	1	1	When the sleep mode is selected, the inverter output is switched OFF, if the frequency reference (or PID output) remains below the sleep mode enter frequency for the set time period. Sleep mode can be used with or without PID control. =0: Disable =1: Enable		
C616	Sleep Mode Enter Frequency	Hz	0.10	0.10	600.00	0.01	This is the frequency used to activate the sleep mode and turn off the inverter.		
C617	Sleep Mode Active Delay	Sec	0	0	999	1	The inverter output will be turned off if the frequency reference (or PID output) remains below sleep mode enter frequency.		
C618	Sleep Mode Wake Up Band	%	5.0	0.0	100.0	0.1	This is set with respect to the max frequency and used as hysteresis when leaving the sleep mode. The inverter will be turned on when the frequency reference (or PID output) exceeds the sleep mode enter frequency + wake up band.		
C619	Sleep Mode Leave Condition		1	1	2	1	Define the condition to leave the sleep mode. =1: Freq Ref > C616 Sleep Mode Enter Freq =2: Freq Ref > A102 Min Freq		

① Control version 7.02 and onwards, this parameter has 8 options and Control version 3.17 and onwards it has 4 options.

GROUP-7: PLC PANEL PARAMETER ①								
C701	PLC Panel Parameter 1		0	0	32767	1	PLC panel parameter 1 & 2 are used in-built PLC for Timer 1 application	
C702	PLC Panel Parameter 2		0	0	32767	1		
C703	PLC Panel Parameter 3		0	0	32767	1	PLC panel parameter 3 & 4 are used in-built PLC for Timer 2 application	
C704	PLC Panel Parameter 4		0	0	32767	1		
C705	PLC Panel Parameter 5		0	0	32767	1	PLC panel parameter 5 & 6 are used in-built PLC for Timer 3 application	
C706	PLC Panel Parameter 6		0	0	32767	1		
C707	PLC Panel Parameter 7		0	0	32767	1	PLC panel parameter 7 & 8 are used in-built PLC for Timer 4 application	
C708	PLC Panel Parameter 8		0	0	32767	1		
C709	PLC Panel Parameter 9		0	0	32767	1	PLC panel parameter 9 can be used in-built PLC application.	
C710	PLC Panel Parameter 10		0	0	32767	1	PLC panel parameter 10 can be used in-built PLC application.	
C711	PLC Panel Parameter 11		0	0	32767	1	PLC panel parameter 11 can be used in-built PLC application.	
C712	PLC Panel Parameter 12		0	0	32767	1	PLC panel parameter 12 can be used in-built PLC application.	
① Available in control version 7.02 and onwards.								

MODE-D: Auxiliary Drive Parameters

No.	Parameter	Unit	Def	Min	Max	Res	Description	WP
GROUP-1: MOTOR PARAMETERS								
D101	Motor Voltage	Vac	415	380	460	1	Set the rated motor nameplate voltage.	✓
D102	Motor Current	Amp	M304	0.3* M304	M304	0.1	Insert the rated motor current from the nameplate.	
D103	Motor Frequency	Hz	50.0	30.0	600.0	0.1	Set the rated base frequency from the nameplate.	
D104	Motor Speed	rpm	1500	1	36000	1	Set the base speed from the motor nameplate.	
D105	Motor Output Rating	kW	M305	0.1	1500.0	0.1	The motor's rated output at the base speed is set from the nameplate.	
GROUP-2: FREQUENCY SETTING								
D201	Local Set Frequency	Hz	10.00	0.10	600.00	0.01	This is the frequency set from the operation panel for auxiliary motor.	
D202	Min Frequency	Hz	0.10	0.10	600.00	0.01	These two Parameters are used to configure Minimum and Maximum Frequency of the AC DRIVE for auxiliary motor.	
D203	Max Frequency	Hz	50.00	0.10	600.00	0.01		
D204	Frequency Reference Input ①		1	1	18	1	This is used to select the speed reference for auxiliary drive. =1: Local =2: FSV 0-10V =3: FSI 4-20mA =4: FSV 0-5V =5: FSI 0-20mA =6: FSV 10-0V =7: FSI 20-4mA =8: FSV 5-0V =9: FSI 20-0mA =10: Static pot =11: Serial =12: PID Output =13: VIN 0-10V =14: IIN 4-20mA =15: PLC A-O/P 1 =16: PLC A-O/P 2 =17: PLC A-O/P 3 =18: PLC A-O/P 4	
D205	Line Speed Setting	rpm	1500	0	3000	1	The set value will be displayed as motor speed in *M102* at 50Hz when auxiliary drive is selected.	
D206	Acceleration Time-1	Sec	10.0	0.1	6000.0	0.1	Time needed for the speed to change from zero to maximum.	
D207	Deceleration Time-1	Sec	20.0	0.1	6000.0	0.1	Time needed for the speed to change from maximum to zero.	
GROUP-3: TORQUE BOOST								
D301	Manual Torque Boost Setting	%	0	0.0	20.0	0.1	When setting manually, set the boost voltage at 0Hz as a percentage in respect to the rated output voltage. When programmed to zero, it will be disabled.	
D302	Slip Compensation	Hz	0.0	0.0	5.0	0.1	Set the motor's rated slip. When setting manually, set the slip frequency for the motor rated load in respect to the base frequency. The output frequency changes according to the motor rated torque.	
D303	DC Brake Start Frequency	Hz	1.50	0.10	50.00	0.01	It is a frequency at which DC braking is initiated during stop.	
D304	DC Brake Current	%	50	15	150	1	Configure amount of current available for the DC braking when DC braking is used during stop.	
D305	DC Brake Time	Sec	0.0	0.0	25.0	0.1	It is amount of time that DC braking will be applied when stop command is issued. To disable DC Braking operation set this parameter to zero.	

① Control version 7.02 and onwards, it has 18 options and Control version 3.17 and onwards it has 14 options.

No.	Parameter	Unit	Def	Min	Max	Res	Description	WP
GROUP-4: LIMITING PARAMETER								
D401	Stall Current Limit	%	150.0	0.0	200.0	0.1	Set the current value as a percentage of motor rated current for normal running condition.	
D402	Adjustable Over Current Level	%	300	50	300	1	Set the upper current limit as a percentage of motor rated current for running condition. When set to 300%, this feature is disabled.	
D403	Acceleration Current Limit	%	150	50	200	1	Set the upper current limit as a percentage of motor rated current for Acceleration.	
D404	Under Current Level	%	0	0	90	1	Set the lower current limit as a percentage of motor rated current for running condition.	

MODE-E: Ring Spinning Frame (RSF) Function Parameters

No.	Parameter	Unit	Def	Min	Max	Res	Description	WP
GROUP-1: RSF / PATTERN RUN PARAMETER SELECTION								
E101	RSF/ Pattern Run Selection		1	1	3	1	=1: Disable =2: RSF Function =3: Pattern Run Function	✓
E102	Table-1 Step Selection		15	1	15	1	Select the number of steps for table-1 for RSF.	✓
E103	Table-2 Step Selection		15	1	15	1	Select the number of steps for table-2 for RSF.	✓
E104	Table-3 Step Selection		15	1	15	1	Select the number of steps for table-3 for RSF.	✓
E105	Doff End Alarm Time	Sec	1	0.1	3000	0.1	Outputs an alarm signal for the set time from completion of the final step until directly before stoppage.	
E106	Hank Count Gain		1.000	0.001	30.000	0.001	This is hank count calculation gain used to display the hank count.	
E107	Hank Gain Multiplier		2	1	3	1	=1: X0.1 =2: X1.0 =3: X10	
E108	Table Selection		1	1	3	1	Select the required table for RSF / Pattern Run function.	✓
GROUP-2: RSF FREQUENCY FOR TABLE-1								
E201	Freq T1-STP1	Hz	5.00	0.01	600	0.01	Set frequency for Table-1, Step-1.	
E202	Freq T1-STP2	Hz	5.00	0.01	600	0.01	Set frequency for Table-1, Step-2.	
E203	Freq T1-STP3	Hz	5.00	0.01	600	0.01	Set frequency for Table-1, Step-3.	
E204	Freq T1-STP4	Hz	5.00	0.01	600	0.01	Set frequency for Table-1, Step-4.	
E205	Freq T1-STP5	Hz	5.00	0.01	600	0.01	Set frequency for Table-1, Step-5.	
E206	Freq T1-STP6	Hz	5.00	0.01	600	0.01	Set frequency for Table-1, Step-6.	
E207	Freq T1-STP7	Hz	5.00	0.01	600	0.01	Set frequency for Table-1, Step-7.	
E208	Freq T1-STP8	Hz	5.00	0.01	600	0.01	Set frequency for Table-1, Step-8.	
E209	Freq T1-STP9	Hz	5.00	0.01	600	0.01	Set frequency for Table-1, Step-9.	
E210	Freq T1-STP10	Hz	5.00	0.01	600	0.01	Set frequency for Table-1, Step-10.	
E211	Freq T1-STP11	Hz	5.00	0.01	600	0.01	Set frequency for Table-1, Step-11.	
E212	Freq T1-STP12	Hz	5.00	0.01	600	0.01	Set frequency for Table-1, Step-12.	
E213	Freq T1-STP13	Hz	5.00	0.01	600	0.01	Set frequency for Table-1, Step-13.	
E214	Freq T1-STP14	Hz	5.00	0.01	600	0.01	Set frequency for Table-1, Step-14.	
E215	Freq T1-STP15	Hz	5.00	0.01	600	0.01	Set frequency for Table-1, Step-15.	
GROUP-3: RSF TIME FOR TABLE-1								
E301	RSF Time T1-STP1	Sec	10.0	0.1	6000.0	0.1	Set time for Table-1, Step-1 for RSF function.	
E302	RSF Time T1-STP2	Sec	10.0	0.1	6000.0	0.1	Set time for Table-1, Step-2 for RSF function.	
E303	RSF Time T1-STP3	Sec	10.0	0.1	6000.0	0.1	Set time for Table-1, Step-3 for RSF function.	
E304	RSF Time T1-STP4	Sec	10.0	0.1	6000.0	0.1	Set time for Table-1, Step-4 for RSF function.	

No.	Parameter	Unit	Def	Min	Max	Res	Description	WP
E305	RSF Time T1-STP5	Sec	10.0	0.1	6000.0	0.1	Set time for Table-1, Step-5 for RSF function.	
E306	RSF Time T1-STP6	Sec	10.0	0.1	6000.0	0.1	Set time for Table-1, Step-6 for RSF function.	
E307	RSF Time T1-STP7	Sec	10.0	0.1	6000.0	0.1	Set time for Table-1, Step-7 for RSF function.	
E308	RSF Time T1-STP8	Sec	10.0	0.1	6000.0	0.1	Set time for Table-1, Step-8 for RSF function.	
E309	RSF Time T1-STP9	Sec	10.0	0.1	6000.0	0.1	Set time for Table-1, Step-9 for RSF function.	
E310	RSF Time T1-STP10	Sec	10.0	0.1	6000.0	0.1	Set time for Table-1, Step-10 for RSF function.	
E311	RSF Time T1-STP11	Sec	10.0	0.1	6000.0	0.1	Set time for Table-1, Step-11 for RSF function.	
E312	RSF Time T1-STP12	Sec	10.0	0.1	6000.0	0.1	Set time for Table-1, Step-12 for RSF function.	
E313	RSF Time T1-STP13	Sec	10.0	0.1	6000.0	0.1	Set time for Table-1, Step-13 for RSF function.	
E314	RSF Time T1-STP14	Sec	10.0	0.1	6000.0	0.1	Set time for Table-1, Step-14 for RSF function.	
E315	RSF Time T1-STP15	Sec	10.0	0.1	6000.0	0.1	Set time for Table-1, Step-15 for RSF function.	
GROUP-4: RSF FREQUENCY FOR TABLE-2								
E401	Freq T2-STP1	Hz	5.00	0.01	600	0.01	Set frequency for Table-2, Step-1.	
E402	Freq T2-STP2	Hz	5.00	0.01	600	0.01	Set frequency for Table-2, Step-2.	
E403	Freq T2-STP3	Hz	5.00	0.01	600	0.01	Set frequency for Table-2, Step-3.	
E404	Freq T2-STP4	Hz	5.00	0.01	600	0.01	Set frequency for Table-2, Step-4.	
E405	Freq T2-STP5	Hz	5.00	0.01	600	0.01	Set frequency for Table-2, Step-5.	
E406	Freq T2-STP6	Hz	5.00	0.01	600	0.01	Set frequency for Table-2, Step-6.	
E407	Freq T2-STP7	Hz	5.00	0.01	600	0.01	Set frequency for Table-2, Step-7.	
E408	Freq T2-STP8	Hz	5.00	0.01	600	0.01	Set frequency for Table-2, Step-8.	
E409	Freq T2-STP9	Hz	5.00	0.01	600	0.01	Set frequency for Table-2, Step-9.	
E410	Freq T2-STP10	Hz	5.00	0.01	600	0.01	Set frequency for Table-2, Step-10.	
E411	Freq T2-STP11	Hz	5.00	0.01	600	0.01	Set frequency for Table-2, Step-11.	
E412	Freq T2-STP12	Hz	5.00	0.01	600	0.01	Set frequency for Table-2, Step-12.	
E413	Freq T2-STP13	Hz	5.00	0.01	600	0.01	Set frequency for Table-2, Step-13.	
E414	Freq T2-STP14	Hz	5.00	0.01	600	0.01	Set frequency for Table-2, Step-14.	
E415	Freq T2-STP15	Hz	5.00	0.01	600	0.01	Set frequency for Table-2, Step-15.	
GROUP-5: RSF TIME FOR TABLE-2								
E501	RSF Time T2-STP1	Sec	10.0	0.1	6000.0	0.1	Set time for Table-2, Step-1 for RSF function.	
E502	RSF Time T2-STP2	Sec	10.0	0.1	6000.0	0.1	Set time for Table-2, Step-2 for RSF function.	
E503	RSF Time T2-STP3	Sec	10.0	0.1	6000.0	0.1	Set time for Table-2, Step-3 for RSF function.	
E504	RSF Time T2-STP4	Sec	10.0	0.1	6000.0	0.1	Set time for Table-2, Step-4 for RSF function.	

No.	Parameter	Unit	Def	Min	Max	Res	Description	WP
E505	RSF Time T2-STP5	Sec	10.0	0.1	6000.0	0.1	Set time for Table-2, Step-5 for RSF function.	
E506	RSF Time T2-STP6	Sec	10.0	0.1	6000.0	0.1	Set time for Table-2, Step-6 for RSF function.	
E507	RSF Time T2-STP7	Sec	10.0	0.1	6000.0	0.1	Set time for Table-2, Step-7 for RSF function.	
E508	RSF Time T2-STP8	Sec	10.0	0.1	6000.0	0.1	Set time for Table-2, Step-8 for RSF function.	
E509	RSF Time T2-STP9	Sec	10.0	0.1	6000.0	0.1	Set time for Table-2, Step-9 for RSF function.	
E510	RSF Time T2-STP10	Sec	10.0	0.1	6000.0	0.1	Set time for Table-2, Step-10 for RSF function.	
E511	RSF Time T2-STP11	Sec	10.0	0.1	6000.0	0.1	Set time for Table-2, Step-11 for RSF function.	
E512	RSF Time T2-STP12	Sec	10.0	0.1	6000.0	0.1	Set time for Table-2, Step-12 for RSF function.	
E513	RSF Time T2-STP13	Sec	10.0	0.1	6000.0	0.1	Set time for Table-2, Step-13 for RSF function.	
E514	RSF Time T2-STP14	Sec	10.0	0.1	6000.0	0.1	Set time for Table-2, Step-14 for RSF function.	
E515	RSF Time T2-STP15	Sec	10.0	0.1	6000.0	0.1	Set time for Table-2, Step-15 for RSF function.	
GROUP-6: RSF FREQUENCY FOR TABLE-3								
E601	Freq T3-STP1	Hz	5.00	0.01	600	0.01	Set frequency for Table-3, Step-1.	
E602	Freq T3-STP2	Hz	5.00	0.01	600	0.01	Set frequency for Table-3, Step-2.	
E603	Freq T3-STP3	Hz	5.00	0.01	600	0.01	Set frequency for Table-3, Step-3.	
E604	Freq T3-STP4	Hz	5.00	0.01	600	0.01	Set frequency for Table-3, Step-4.	
E605	Freq T3-STP5	Hz	5.00	0.01	600	0.01	Set frequency for Table-3, Step-5.	
E606	Freq T3-STP6	Hz	5.00	0.01	600	0.01	Set frequency for Table-3, Step-6.	
E607	Freq T3-STP7	Hz	5.00	0.01	600	0.01	Set frequency for Table-3, Step-7.	
E608	Freq T3-STP8	Hz	5.00	0.01	600	0.01	Set frequency for Table-3, Step-8.	
E609	Freq T3-STP9	Hz	5.00	0.01	600	0.01	Set frequency for Table-3, Step-9.	
E610	Freq T3-STP10	Hz	5.00	0.01	600	0.01	Set frequency for Table-3, Step-10.	
E611	Freq T3-STP11	Hz	5.00	0.01	600	0.01	Set frequency for Table-3, Step-11.	
E612	Freq T3-STP12	Hz	5.00	0.01	600	0.01	Set frequency for Table-3, Step-12.	
E613	Freq T3-STP13	Hz	5.00	0.01	600	0.01	Set frequency for Table-3, Step-13.	
E614	Freq T3-STP14	Hz	5.00	0.01	600	0.01	Set frequency for Table-3, Step-14.	
E615	Freq T3-STP15	Hz	5.00	0.01	600	0.01	Set frequency for Table-3, Step-15.	
GROUP-7: RSF TIME FOR TABLE-3								
E701	RSF Time T3-STP1	Sec	10.0	0.1	6000.0	0.1	Set time for Table-3, Step-1 for RSF function.	
E702	RSF Time T3-STP2	Sec	10.0	0.1	6000.0	0.1	Set time for Table-3, Step-2 for RSF function.	
E703	RSF Time T3-STP3	Sec	10.0	0.1	6000.0	0.1	Set time for Table-3, Step-3 for RSF function.	
E704	RSF Time T3-STP4	Sec	10.0	0.1	6000.0	0.1	Set time for Table-3, Step-4 for RSF function.	

No.	Parameter	Unit	Def	Min	Max	Res	Description	WP
E705	RSF Time T3-STP5	Sec	10.0	0.1	6000.0	0.1	Set time for Table-3, Step-5 for RSF function.	
E706	RSF Time T3-STP6	Sec	10.0	0.1	6000.0	0.1	Set time for Table-3, Step-6 for RSF function.	
E707	RSF Time T3-STP7	Sec	10.0	0.1	6000.0	0.1	Set time for Table-3, Step-7 for RSF function.	
E708	RSF Time T3-STP8	Sec	10.0	0.1	6000.0	0.1	Set time for Table-3, Step-8 for RSF function.	
E709	RSF Time T3-STP9	Sec	10.0	0.1	6000.0	0.1	Set time for Table-3, Step-9 for RSF function.	
E710	RSF Time T3-STP10	Sec	10.0	0.1	6000.0	0.1	Set time for Table-3, Step-10 for RSF function.	
E711	RSF Time T3-STP11	Sec	10.0	0.1	6000.0	0.1	Set time for Table-3, Step-11 for RSF function.	
E712	RSF Time T3-STP12	Sec	10.0	0.1	6000.0	0.1	Set time for Table-3, Step-12 for RSF function.	
E713	RSF Time T3-STP13	Sec	10.0	0.1	6000.0	0.1	Set time for Table-3, Step-13 for RSF function.	
E714	RSF Time T3-STP14	Sec	10.0	0.1	6000.0	0.1	Set time for Table-3, Step-14 for RSF function.	
E715	RSF Time T3-STP15	Sec	10.0	0.1	6000.0	0.1	Set time for Table-3, Step-15 for RSF function.	

MODE-G: Pattern Run Function Parameters

No.	Parameter	Unit	Def	Min	Max	Res	Description	WP
GROUP-1: MODE SELECTION FOR PATTERN RUN TABLE-1								
G101	PR Mode T1-STP1		1	1	3	1	Select the required mode for pattern run function for each step of Table-1 =1: STOP =2: FORWARD =3: REVERSE	
G102	PR Mode T1-STP2		1	1	3	1		
G103	PR Mode T1-STP3		1	1	3	1		
G104	PR Mode T1-STP4		1	1	3	1		
G105	PR Mode T1-STP5		1	1	3	1		
G106	PR Mode T1-STP6		1	1	3	1		
G107	PR Mode T1-STP7		1	1	3	1		
G108	PR Mode T1-STP8		1	1	3	1		
G109	PR Mode T1-STP9		1	1	3	1		
G110	PR Mode T1-STP10		1	1	3	1		
G111	PR Mode T1-STP11		1	1	3	1		
G112	PR Mode T1-STP12		1	1	3	1		
G113	PR Mode T1-STP13		1	1	3	1		
G114	PR Mode T1-STP14		1	1	3	1		
G115	PR Mode T1-STP15		1	1	3	1		
GROUP-2: MODE SELECTION FOR PATTERN RUN TABLE-2								
G201	PR Mode T2-STP1		1	1	3	1	Select the required mode for pattern run function for each step of Table-2 =1: STOP =2: FORWARD =3: REVERSE	
G202	PR Mode T2-STP2		1	1	3	1		
G203	PR Mode T2-STP3		1	1	3	1		
G204	PR Mode T2-STP4		1	1	3	1		
G205	PR Mode T2-STP5		1	1	3	1		
G206	PR Mode T2-STP6		1	1	3	1		
G207	PR Mode T2-STP7		1	1	3	1		
G208	PR Mode T2-STP8		1	1	3	1		
G209	PR Mode T2-STP9		1	1	3	1		
G210	PR Mode T2-STP10		1	1	3	1		
G211	PR Mode T2-STP11		1	1	3	1		
G212	PR Mode T2-STP12		1	1	3	1		
G213	PR Mode T2-STP13		1	1	3	1		
G214	PR Mode T2-STP14		1	1	3	1		
G215	PR Mode T2-STP15		1	1	3	1		

No.	Parameter	Unit	Def	Min	Max	Res	Description	WP
GROUP-3: PATTERN TIME FOR TABLE-1								
G301	PR Time T1-STP1	Sec	10.0	0.1	6000.0	0.1	Set time for Table-1, Step-1 for Pattern Run.	
G302	PR Time T1-STP2	Sec	10.0	0.1	6000.0	0.1	Set time for Table-1, Step-2 for Pattern Run.	
G303	PR Time T1-STP3	Sec	10.0	0.1	6000.0	0.1	Set time for Table-1, Step-3 for Pattern Run.	
G304	PR Time T1-STP4	Sec	10.0	0.1	6000.0	0.1	Set time for Table-1, Step-4 for Pattern Run.	
G305	PR Time T1-STP5	Sec	10.0	0.1	6000.0	0.1	Set time for Table-1, Step-5 for Pattern Run.	
G306	PR Time T1-STP6	Sec	10.0	0.1	6000.0	0.1	Set time for Table-1, Step-6 for Pattern Run.	
G307	PR Time T1-STP7	Sec	10.0	0.1	6000.0	0.1	Set time for Table-1, Step-7 for Pattern Run.	
G308	PR Time T1-STP8	Sec	10.0	0.1	6000.0	0.1	Set time for Table-1, Step-8 for Pattern Run.	
G309	PR Time T1-STP9	Sec	10.0	0.1	6000.0	0.1	Set time for Table-1, Step-9 for Pattern Run.	
G310	PR Time T1-STP10	Sec	10.0	0.1	6000.0	0.1	Set time for Table-1, Step-10 for Pattern Run.	
G311	PR Time T1-STP11	Sec	10.0	0.1	6000.0	0.1	Set time for Table-1, Step-11 for Pattern Run.	
G312	PR Time T1-STP12	Sec	10.0	0.1	6000.0	0.1	Set time for Table-1, Step-12 for Pattern Run.	
G313	PR Time T1-STP13	Sec	10.0	0.1	6000.0	0.1	Set time for Table-1, Step-13 for Pattern Run.	
G314	PR Time T1-STP14	Sec	10.0	0.1	6000.0	0.1	Set time for Table-1, Step-14 for Pattern Run.	
G315	PR Time T1-STP15	Sec	10.0	0.1	6000.0	0.1	Set time for Table-1, Step-15 for Pattern Run.	
GROUP-4: PATTERN TIME FOR TABLE-2								
G401	PR Time T2-STP1	Sec	10.0	0.1	6000.0	0.1	Set time for Table-2, Step-1 for Pattern Run.	
G402	PR Time T2-STP2	Sec	10.0	0.1	6000.0	0.1	Set time for Table-2, Step-2 for Pattern Run.	
G403	PR Time T2-STP3	Sec	10.0	0.1	6000.0	0.1	Set time for Table-2, Step-3 for Pattern Run.	
G404	PR Time T2-STP4	Sec	10.0	0.1	6000.0	0.1	Set time for Table-2, Step-4 for Pattern Run.	
G405	PR Time T2-STP5	Sec	10.0	0.1	6000.0	0.1	Set time for Table-2, Step-5 for Pattern Run.	
G406	PR Time T2-STP6	Sec	10.0	0.1	6000.0	0.1	Set time for Table-2, Step-6 for Pattern Run.	
G407	PR Time T2-STP7	Sec	10.0	0.1	6000.0	0.1	Set time for Table-2, Step-7 for Pattern Run.	
G408	PR Time T2-STP8	Sec	10.0	0.1	6000.0	0.1	Set time for Table-2, Step-8 for Pattern Run.	
G409	PR Time T2-STP9	Sec	10.0	0.1	6000.0	0.1	Set time for Table-2, Step-9 for Pattern Run.	
G410	PR Time T2-STP10	Sec	10.0	0.1	6000.0	0.1	Set time for Table-2, Step-10 for Pattern Run.	
G411	PR Time T2-STP11	Sec	10.0	0.1	6000.0	0.1	Set time for Table-2, Step-11 for Pattern Run.	
G412	PR Time T2-STP12	Sec	10.0	0.1	6000.0	0.1	Set time for Table-2, Step-12 for Pattern Run.	
G413	PR Time T2-STP13	Sec	10.0	0.1	6000.0	0.1	Set time for Table-2, Step-13 for Pattern Run.	
G414	PR Time T2- PR STP14	Sec	10.0	0.1	6000.0	0.1	Set time for Table-2, Step-14 for Pattern Run.	
G415	PR Time T2-STP15	Sec	10.0	0.1	6000.0	0.1	Set time for Table-2, Step-15 for Pattern Run.	

No.	Parameter	Unit	Def	Min	Max	Res	Description	WP
GROUP-5: RETURN STEP FOR TABLE-1								
G501	Return Step T1-STP1		1	1	14	1	Set return step for Table-1, Step-1.	
G502	Return Step T1-STP2		1	1	14	1	Set return step for Table-1, Step-2.	
G503	Return Step T1-STP3		1	1	14	1	Set return step for Table-1, Step-3.	
G504	Return Step T1-STP4		1	1	14	1	Set return step for Table-1, Step-4.	
G505	Return Step T1-STP5		1	1	14	1	Set return step for Table-1, Step-5.	
G506	Return Step T1-STP6		1	1	14	1	Set return step for Table-1, Step-6.	
G507	Return Step T1-STP7		1	1	14	1	Set return step for Table-1, Step-7.	
G508	Return Step T1-STP8		1	1	14	1	Set return step for Table-1, Step-8.	
G509	Return Step T1-STP9		1	1	14	1	Set return step for Table-1, Step-9.	
G510	Return Step T1-STP10		1	1	14	1	Set return step for Table-1, Step-10.	
G511	Return Step T1-STP11		1	1	14	1	Set return step for Table-1, Step-11.	
G512	Return Step T1-STP12		1	1	14	1	Set return step for Table-1, Step-12.	
G513	Return Step T1-STP13		1	1	14	1	Set return step for Table-1, Step-13.	
G514	Return Step T1-STP14		1	1	14	1	Set return step for Table-1, Step-14.	
G515	Return Step T1-STP15		1	1	14	1	Set return step for Table-1, Step-15.	
GROUP-6: RETURN STEP FOR TABLE-2								
G601	Return Step T2-STP1		1	1	14	1	Set return step for Table-2, Step-1.	
G602	Return Step T2-STP2		1	1	14	1	Set return step for Table-2, Step-2.	
G603	Return Step T2-STP3		1	1	14	1	Set return step for Table-2, Step-3.	
G604	Return Step T2-STP4		1	1	14	1	Set return step for Table-2, Step-4.	
G605	Return Step T2-STP5		1	1	14	1	Set return step for Table-2, Step-5.	
G606	Return Step T2-STP6		1	1	14	1	Set return step for Table-2, Step-6.	
G607	Return Step T2-STP7		1	1	14	1	Set return step for Table-2, Step-7.	

No.	Parameter	Unit	Def	Min	Max	Res	Description	WP
G608	Return Step T2-STP8		1	1	14	1	Set return step for Table-2, Step-8.	
G609	Return Step T2-STP9		1	1	14	1	Set return step for Table-2, Step-9.	
G610	Return Step T2-STP10		1	1	14	1	Set return step for Table-2, Step-10.	
G611	Return Step T2-STP11		1	1	14	1	Set return step for Table-2, Step-11.	
G612	Return Step T2-STP12		1	1	14	1	Set return step for Table-2, Step-12.	
G613	Return Step T2-STP13		1	1	14	1	Set return step for Table-2, Step-13.	
G614	Return Step T2-STP14		1	1	14	1	Set return step for Table-2, Step-14.	
G615	Return Step T2-STP15		1	1	14	1	Set return step for Table-2, Step-15.	

MODE-H: APPLICATION SPECIFIC FUNCTIONS

No.	Parameter	Unit	Def	Min	Max	Res	Description	WP
GROUP-1: MULTI-PUMP FUNCTION PARAMETERS								
H101	No Of Pump Selection		0	0	4	1	Select number of pumps to be controlled.	
H102	Pump Start Hold Time	Sec	60.0	0.1	3600.0	0.1	If the PID output reaches to upper limit and remains there for more than the set time, the next pump will be switched ON.	
H103	Pump Stop Hold Time	Sec	60.0	0.1	3600.0	0.1	If the PID output reaches to lower limit and remains there for more than the set time, the next pump will be switched OFF.	
H104	Pump Continuous ON Time Limit	Hrs	8	2	168	1	If pump's ON/OFF control is not carried out for more than the set time, the pump will change to the longest operating pump to the shortest operating pump.	
H105	Pump Changeover Time	Sec	3	1	120	1	Set the time for changing from the pump that has been operating longest to the pump operating shortest.	

MODE-P: IN-BUILT PLC FUNCTIONS ①

No.	Parameter	Unit	Def	Min	Max	Res	Description	WP
GROUP-1: IN-BUILT PLC COMMAND PARAMETERS ①								
P101 ~ P110	PLC Inst 1 ~ PLC Inst 10		0	0	-	1	In-built PLC Command 1 ~ 10.	
GROUP-2: IN-BUILT PLC COMMAND PARAMETERS ①								
P201 ~ P210	PLC Inst 11 ~ PLC Inst 20		0	0	-	1	In-built PLC Command 11 ~ 20.	
GROUP-3: IN-BUILT PLC COMMAND PARAMETERS ①								
P301 ~ P310	PLC Inst 21 ~ PLC Inst 30		0	0	-	1	In-built PLC Command 21 ~ 30.	
GROUP-4: IN-BUILT PLC COMMAND PARAMETERS ①								
P401 ~ P410	PLC Inst 31 ~ PLC Inst 40		0	0	-	1	In-built PLC Command 31 ~ 40.	
GROUP-5: IN-BUILT PLC COMMAND PARAMETERS ①								
P501 ~ P510	PLC Inst 41 ~ PLC Inst 50		0	0	-	1	In-built PLC Command 41 ~ 50.	
GROUP-6: IN-BUILT PLC COMMAND PARAMETERS ①								
P601 ~ P610	PLC Inst 51 ~ PLC Inst 60		0	0	-	1	In-built PLC Command 51 ~ 60.	
GROUP-7: IN-BUILT PLC COMMAND PARAMETERS ①								
P701 ~ P710	PLC Inst 61 ~ PLC Inst 70		0	0	-	1	In-built PLC Command 61 ~ 70.	
GROUP-8: IN-BUILT PLC COMMAND PARAMETERS ①								
P801 ~ P810	PLC Inst 71 ~ PLC Inst 80		0	0	-	1	In-built PLC Command 71 ~ 80.	
GROUP-9: IN-BUILT PLC COMMAND PARAMETERS ①								
P901 ~ P910	PLC Inst 81 ~ PLC Inst 90		0	0	-	1	In-built PLC Command 81 ~ 90.	
GROUP-A: IN-BUILT PLC COMMAND PARAMETERS ①								
PA01 ~ PA10	PLC Inst 91 ~ PLC Inst 100		0	0	-	1	In-built PLC Command 91 ~ 100.	
① Mode-P is available in Control version 7.02 and onwards.								

FUNCTION EXPLANATIONS

GROUP-1

M101: Output Frequency (Hz)

It displays output frequency of AC DRIVE in Hz. When the AC DRIVE is stop, it will display zero. When auxiliary drive is selected, this parameter displays the output frequency of the auxiliary drive. When selected for the normal parameter display in *A601~A604*, the value will be displayed with "**Hz**" unit.

M102: Motor Speed (rpm)

It displays the motor / shaft speed in rpm. When the AC DRIVE is stop, it will display zero.

If Motor control mode *A401 = 1, 3*: It displays calculated motor speed or shaft rpm using Line speed display setting *A104 or D205 (for auxiliary drive)* and *M101*.

If Motor control mode *A401 = 2, 4*: It displays actual speed of motor shaft using encoder.

When auxiliary drive is selected, this parameter displays the auxiliary motor speed.

When selected for the normal parameter display in *A601~A604*, the value will be displayed with "**rpm**" unit.

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M103: Output Current (Amp)

It displays actual output current of AC DRIVE in Ampere. When the AC DRIVE is stop, it will display zero. When auxiliary drive is selected, this parameter displays the output current of the auxiliary drive.

When selected for the normal parameter display in *A601~A604*, the value will be displayed with "**Amp**" unit.

M104: Output Current (%)

It displays actual output current of AC DRIVE as a percentage of rated motor current *B103*. When auxiliary drive is selected the rated motor current programmed in *D103* is considered.

Output current (%) = Output current *(M103)* X 100 / Motor current *(B103 or D103)*

When the AC DRIVE is stop, it will display zero. When selected for the normal parameter display in *A601~A604*, the value will be displayed with "**%L**" unit.

M105: Set Frequency (Hz*)

This parameter displays the set value of frequency in Hz. When local (Digital Operation Panel) option is selected as frequency reference input in *A106*, it will display the value of *A101* or *D201 (*for auxiliary drive). When selected for the normal parameter display in *A601~A604*, the value will be displayed with "**Hz***" unit.

M106: Frequency Reference Input

It displays currently selected frequency reference input source in *A106* or *D204* (for auxiliary drive).

M107: Set Torque (%)

This parameter displays the set value of torque in %, when motor control mode *A401 = 3,4*. If local (Digital Operation Panel) option is selected as torque reference input, it will display the value of *A107*.

M108: Torque Reference Input

It displays currently selected torque reference input source in *A108*, when motor control mode *A401 = 3, 4.*

M109: PID Reference

This parameter displays the value of currently selected PID reference input source in the unit selected in C614. When local (Digital Operation Panel) option is selected as PID reference input source, it will display the value of *C611*. When selected for the normal parameter display in *A601~A604*, the value will be displayed with "**PR**" unit.

M110: PID Feedback

This parameter displays the value of currently selected PID feedback input source in the unit selected in C614. When selected for the normal parameter display in *A601~A604*, the value will be displayed with "**Fb**" unit.

M111: FSV Input Voltage

This parameter displays the analog input voltage at FSV. This is applicable to the control version 7.02 and thereafter.

M112: FSI Input Current

This parameter displays the analog input current at FSI. This is applicable to the control version 7.02 and thereafter.

M113: VIN Input Voltage

This parameter displays the analog input voltage at VIN. This is applicable to the control version 7.02 and thereafter.

M114: IIN Input Current

This parameter displays the analog input current at IIN. This is applicable to the control version 7.02 and thereafter.

M115: Output Current U

This parameter displays the Output current of U phase. This is applicable to the control version 7.02 and thereafter.

M116: Output Current V

This parameter displays the Output current of V phase. This is applicable to the control version 7.02 and thereafter.

M117: Output Current W

This parameter displays the Output current of W phase. This is applicable to the control version 7.02 and thereafter.

GROUP-2

M201: Input Voltage Vry (Vac)

This parameter displays the input line-to-line voltage between R & Y at input. This is calculated based on the DC bus voltage and output power. This may differ from the actual input voltage. When selected for the normal parameter display in *A601~A604*, the value will be displayed with "**Vry**" unit.

M202: Input Voltage Vyb (Vac)

This parameter displays the input line-to-line voltage between Y & B at input. This is calculated based on the DC bus voltage and output power. This may differ from the actual input voltage. When selected for the normal parameter display in *A601~A604*, the value will be displayed with "**Vyb**" unit.

M203: Output Voltage (Vac)

This parameter displays the output line-to-line voltage. This is calculated voltage based on the voltage command. This may differ from the actual output voltage. The actual output voltage depends on input supply voltage. When the AC DRIVE is stop, it will display zero. When auxiliary drive is selected, it displays the output voltage for the auxiliary drive.

When selected for the normal parameter display in *A601~A604*, the value will be displayed with "**Vo**" unit.

M204: DC Bus Voltage (Vdc)

This parameter displays the dc bus voltage. When selected for the normal parameter display in *A601~A604*, the value will be displayed with "**Vdc**" unit.

M205: Output Power (kW)

This parameter displays the output power. This may differ from the actual output power. When the AC DRIVE is stop, it will display zero. When the auxiliary drive is selected, the output power of auxiliary drive is displayed.
When selected for the normal parameter display in *A601~A604*, the value will be displayed with "**kW**" unit.

M206: Energy Meter (kWH)

M207: Energy Meter (MWH)

This parameter displays the total output power consumption per hour basis. This may differ from the actually consumed output energy. This is stored in the non-volatile memory.
When selected for the normal parameter display in *A601~A604*, the value will be displayed with "**kWH**" and "**MWH**" unit respectively.

M208: Heat sink Temperature (℃)

This parameter displays the actual heat sink temperature. When selected for the normal parameter display in *A601~A604*, the value will be displayed with "**℃**" unit.

M209: Torque Current (%)

The torque current value is displayed using the motor rated current *B103* as 100%. This is displayed only if the main drive is selected and motor control mode is vector control *A401=3,4*. When the AC DRIVE is stop, it will display zero.

M210: Excitation Current (%)

The excitation current value is displayed using the motor rated current *B103* as 100%. This is displayed only if the main drive is selected and motor control mode is vector control *A401=3,4*. When the AC DRIVE is stop, it will display zero.

M211: Heat sink Temperature (°F)

This parameter displays the actual heat sink temperature in **°F**. When selected for the normal parameter display in *A601~A604*, the value will be displayed with "**°F**" unit.

M212: Energy Saved in kWH

M213: Energy Saved in MWH

This parameter displays the total power saved per hour basis using VFD. This may differ from the actually saved energy. To get the nearest value, enter the kW consumption in *B112* before the VFD is installed. The energy saved is stored in the non-volatile memory.

M214: Hank Count

This parameter displays the current hank count. The max possible value is 6553.5. It is cleared to zero when power is turned off.

M215: Money Saved with VFD

M216: Money Saved with VFD x1K

This parameter displays the money saved using VFD. This may differ from the actually saved money. To get the nearest value, enter the kW consumption in *B112* before the VFD is installed. Also, enter the energy cost in parameter *B114* and select your currency unit in parameter *B113*.
Parameter *M216* shows the money saved in x1000.

M217: Encoder Count

This parameter displays the Encoder count as per below formula,
Encoder Count = (Encoder Pulses (B109) * Motor Speed (M102)* 4 *Speed loop time (B601)) / (60*1000).

GROUP-3

M301: Total Conductivity Time (Hrs)

The total (cumulative) power on time after product shipment is counted and displayed in this parameter.

M302: Total Run Time (Hrs)

The total (cumulative) AC DRIVE run time after product shipment is counted and displayed in this parameter.

M303: Automatic Tuning display

This parameter displays the progress of auto tuning process, when auto-tuning function is executed. It will start with 0% and reach to 100% when auto-tuning is over. It will show zero otherwise.

M304: Rated Current (A)

This parameter displays the rated current capacity of the unit.

M305: Inverter Type (kW)

This parameter displays the rated kW capacity of the unit.

M306: Control Version

This parameter displays the ROM version of DSP Control Board (PCA-2014A/PCA-2004A) of AC DRIVE.

M307: Programmable Sequence Inputs

This parameter displays the status of various programmable sequence inputs.

M	o	d	e	-	M							G	r	o	u	p	-	3
M	3	0	7		P	S	I	-	1	2	3	4	5	6	7	8		
									0	1	0	0	0	0	0	0		
F	w	d	,	L	c	l	,	N	o	r	m	a	l		R	u	n	

As shown above, line-2 shows the programmable sequence input and line-3 shows the status of respective input. The zero value indicates that the programmable sequence input is OFF and 1 indicates ON. In the above screen, only PSI-2 is ON and the others are OFF. In control version 7.02 and thereafter this parameter show 8 PSI Status and In control version 3.17 and thereafter it is show 6 PSI Status.

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M308: Programmable Sequence Outputs

This parameter displays the status of various programmable sequence outputs.
PSO-5, 6 & 7 indicates the status of trip relay, programmable relay 1 and programmable relay 2 respectively.

M	o	d	e	-	M							G	r	o	u	p	-	3
M	3	0	8		P	S	O	-	1	2	3	4	5	6	7			
									0	1	0	0	0	1	0			
F	w	d	,	L	c	l	,	N	o	r	m	a	l		R	u	n	

As shown above, line-2 shows the programmable sequence output and line-3 shows the status of respective output. The zero value indicates that the programmable sequence output is OFF and 1 indicates ON. In the above screen, only PSO-2 and 6 are ON and the others are OFF.

M309: Unit Serial Number

This parameter displays the serial number of the unit.

M310: Ship Month

This parameter displays the month of unit shipment.

M311: Ship Year

This parameter displays the year of unit shipment.

M312: Display Version

This parameter displays the ROM version of Display Board (PCA-2003B) of AC DRIVE.

M313 to M322: PLC Display 1 to 10

For In-built PLC programming, there are 115 numbers of 16-bit registers out of this, 10 registers can be displayed in parameter M313 to M322.The values of these registers will be saved in EEPROM on power off. This parameters are only applicable in control version 7.02 and thereafter.

M323: PLC FLAG STAT 0-7

For In-built PLC programming, there are 100 numbers of 1-bit flags, 8 of these flag status can be display in parameter M323. This is applicable to the control version 7.02 and thereafter.

GROUP-4: FAULT HISTORY

FLT-1 ~ FLT10: Fault 1 ~ 10

Parameter FLT-1 displays the latest fault. It also displays the DC Bus Voltage (Vdc), Load Current (Amp), Output Frequency (Hz), and Heat sink Temperature (℃) at the time of fault occurrence. Other four parameters Input Voltage (Vry), Total Conductivity Time (Hr), Energy Meter (MWH) and Energy Meter (kWH) will be stored in the next page.

PAGE-1

M	o	d	e	-	M		F	L	T	-	1		G	r	o	u	p	-	4
			E	x	t	e	r	n	a	l		F	a	u	l	t			
		5	8	5		V	d	c					0	.	0		A	m	p
	1	0	.	0	0	H	z							3	5		°	C	

PAGE-2

M	o	d	e	-	M		F	L	T	-	1		G	r	o	u	p	-	4
			E	x	t	e	r	n	a	l		F	a	u	l	t			
		4	2	0		V	r	y			6	0	1	1	0		H	r	
		1	1	0		M	W	H					7	3	5		k	W	H

As shown above, in the first page, line-2 shows the fault code, line-3 shows the DC Bus Voltage & Output Current and line-4 shows the Output Frequency & Heat sink Temperature. In the second page also, line-2 shows the fault code, line-3 shows Input Voltage (Vry) & Total Conductivity Time (Hr) and line-4 shows the Energy Meter (MWH & kWH). If no fault is detected since shipment, line-2 in both the pages will display “No previous fault” and the value of different parameters will be read as zero.

Same way **FLT-2 ~ FLT10** shows the previous fault codes and parameters at the time of fault occurrence.

GROUP-6

M601 ~ M620: Output Current of U, V, W phase and Inverter Unit Current

These parameters display the Output current of U, V and W phase of Inverter Unit 1 to 5, whereas, parameters M604, M608, M612, M616 and M620 display output current of Inverter Unit 1 to 5. It is only applicable in control version 7.05 and thereafter.

GROUP-7

M701: Control Version Parallel Inverter

Indicate ROM version of DSP Based interface board PCA-2013A for parallel inverter. It is only applicable in control version 7.05 and thereafter.

M702: Temperature Inverter Unit (IU) – 2 (℃)

M703: Temperature Inverter Unit (IU) – 3 (℃)

M704: Temperature Inverter Unit (IU) – 4 (℃)

M705: Temperature Inverter Unit (IU) – 5 (℃)

These parameters display the actual heat sink temperature of Inverter Unit 2 to 5. The value will be displayed with "℃" unit. It is only applicable in control version 7.05 and thereafter.

M706: Temperature Diode Unit (DU) – 1 (℃)

M707: Temperature Diode Unit (DU) – 2 (℃)

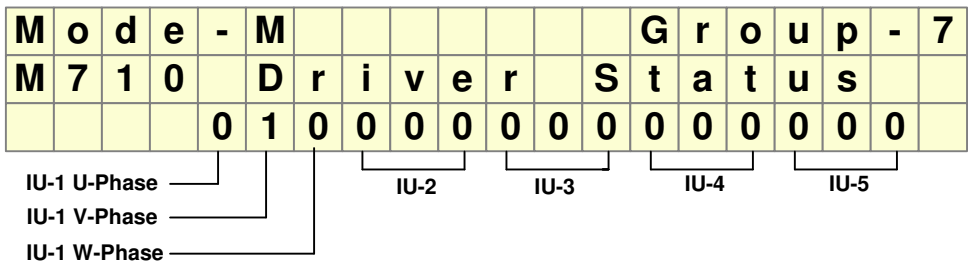
These parameters display the actual heat sink temperature of Diode Unit 1 and 2. The value will be displayed with "℃" unit. It is only applicable in control version 7.05 and thereafter.

M708: Temperature Panel – 1 (℃)

M709: Temperature Panel – 2 (℃)

These parameters display the actual heat sink temperature of Panel 1 and 2. The value will be displayed with "℃" unit. It is only applicable in control version 7.05 and thereafter.

M710: Driver Status



As shown above, line-3 shows the driver fault status of respective IU unit. The zero value indicates no driver fault from IU unit and 1 indicates driver fault from respective phase of respective IU unit. In the above screen, only V phase of IU-1 unit has detected driver fault. The sequence of driver fault status bit is shown in above figure.

MODE – A

GROUP – 1: FREQUENCY SETTING

A101: Local Set Frequency (Hz)

This is the set frequency when the frequency reference input source is ***Local*** **(*A106*=1)**. The output will ramp to this frequency, when start command is given.

The minimum limit for this parameter is decided by minimum frequency *A102*. If *A102* is set higher then *A101*, the value of *A102* is automatically assigned to *A101*.

The maximum value of this parameter is decided by Maximum frequency *A103*. The value of *A101* cannot be set higher than *A103*.

A102: Minimum Frequency (Hz)

This is the minimum output frequency of the AC DRIVE.

In terminal mode, this is the minimum output attained with minimum analog input reference. This value should always be lower then the maximum frequency *A103*. The minimum frequency will be reached after start command with selected acceleration ramp up time. This is applicable to all frequency references including jog select input, preset inputs and static pot inputs.

A103: Maximum Frequency (Hz)

This is the maximum output frequency of the AC DRIVE.
In terminal mode, this is the maximum output attained with maximum analog input reference.

A104: Jog Frequency (Hz)

This frequency setting is selected when executing jogging run with the programmable sequence input command ***Jog Select***. The selected acceleration time *A201* (or *A203*) / deceleration time *A202* (or *A204*) and stop mode *A304* will be applicable to this signal.

If auxiliary drive is selected, then the acceleration time *D206* (or *A203)* / deceleration time *D207 (*or *A204)* will be applicable.

The minimum limit for this parameter is *A102* and maximum limit is *A103*.

Speed search function is carried out, when executing jogging run command, if it is enabled. ***Jog Select*** is valid in all conditions of *A301.* However, *RUN* command has the higher priority then *Jog Select*, if both the signals are input together.

A105: Line Speed Setting

The entered value will be displayed as motor speed in *M102* at 50Hz, if motor control mode *A401=1* (open loop v/f mode). It will not have any effect in other modes.

The final speed of the driven load can be displayed by this parameter. The value to be entered can be derived at with following formula:

Parameter Value = 50 x Desired rpm / Set output frequency

Suppose a line speed of 273 is to be displayed when the output is 90Hz.

Parameter Value = 50 X 273 / 90 = 151.667 = 152

Now, at 90Hz the motor speed *M102* will show (152 X 90 / 50) i.e. 274 rpm.

A106: Frequency Reference Input

This parameter can be used to select the speed reference input to the AC DRIVE. The speed reference can be independently selected from the given options even if the AC DRIVE is controlled from any of three sources, i.e. Local (Digital Operation Panel), Terminal or Serial. The different frequency reference inputs are explained as under. The minimum and maximum limits are decided by

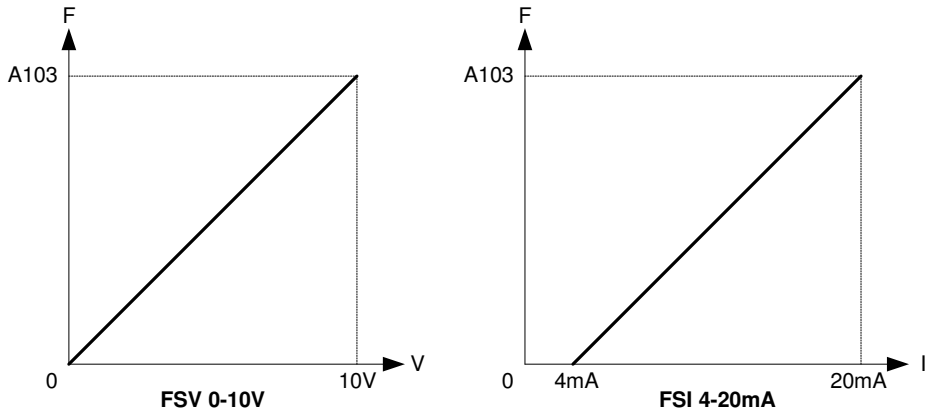
A102 and *A103* respectively in all the options. In control version 7.02 and thereafter this parameter show 18 PSI Status and In control version 3.17 and thereafter it is show 14 PSI Status.

1. Local

When this option is selected, the set frequency *M105* corresponds to local set frequency *A101*. Use Digital Operation Panel (keypad) to change the set value. The monitor mode parameter *M105* shows the value of local set frequency *A101* and *M106* will show keypad as frequency reference input. *The local set frequency A101 will not have any effect in other options.*

2. FSV 0-10V

When this option is selected, the set frequency *M105* corresponds to analog input FSV. The output frequency will be zero at 0V and maximum at 10V.



3. FSI 4-20mA

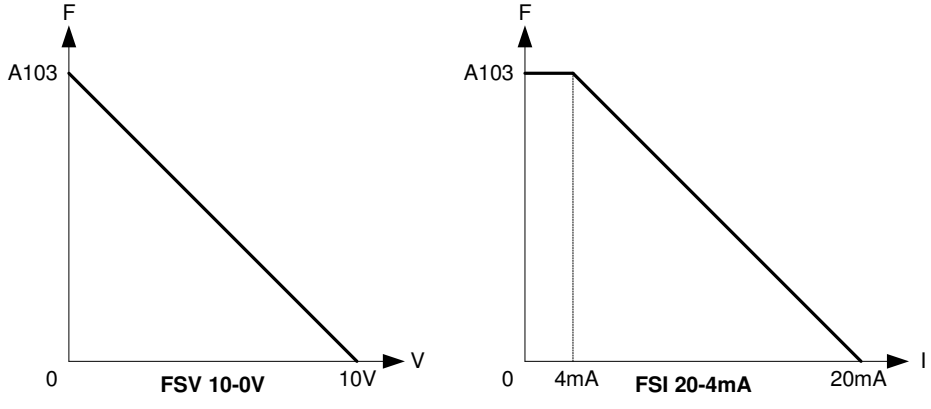
When this option is selected, the set frequency *M105* corresponds to analog input FSI. The output frequency will be zero at 4mA and maximum at 20mA.

4. FSV 0-5V

When this option is selected, the set frequency *M105* corresponds to analog input FSV. The output frequency will be zero at 0V and maximum at 5V.

5. FSI 0-20mA

When this option is selected, the set frequency *M105* corresponds to analog input FSI. The output frequency will be zero at 0mA and maximum at 20mA.



6. FSV 10-0V

This is an inverse to option-2. When this option is selected, the set frequency *M105* corresponds to analog input FSV. The output frequency will be zero at 10V and maximum at 0V.

7. FSI 20-4mA

This is an inverse to option-3. When this option is selected, the set frequency *M105* corresponds to analog input FSI. The output frequency will be zero at 20mA and maximum at 4mA. The maximum limit is decided by *A103*.

8. FSV 5-0V

This is an inverse to option-4. When this option is selected, the set frequency *M105* corresponds to analog input FSV. The output frequency will be zero at 5V and maximum at 0V.

9. FSI 20-0mA

This is an inverse to option-5. When this option is selected, the set frequency *M105* corresponds to analog input FSI. The output frequency will be zero at 20mA and maximum at 0mA.

10. Static potentiometer

When this option is selected, the set frequency *M105* will be decided by programmable sequence inputs. Assign two programmable sequence inputs to ***Freq Increase*** and ***Freq Decrease*** respectively. When ***Freq Increase*** is applied, the set frequency will increase and when ***Freq Decrease*** is applied, the frequency will decrease. If both the signals are applied simultaneously, it will have no effect. The rate of frequency increase / decrease is 0.1Hz at every 100msec.

11. Serial

In this option, the set frequency *M107* can be assigned from serial link.

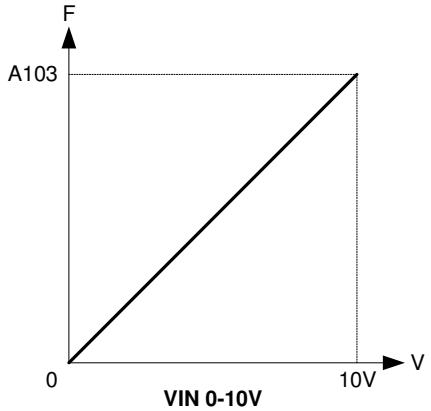
12. PID Output

In this option, the PID output will be the set point. When selecting this input, enable the PID Control in C601. The monitor option M105 will display the corresponding set frequency value, even if the AC DRIVE is stop.

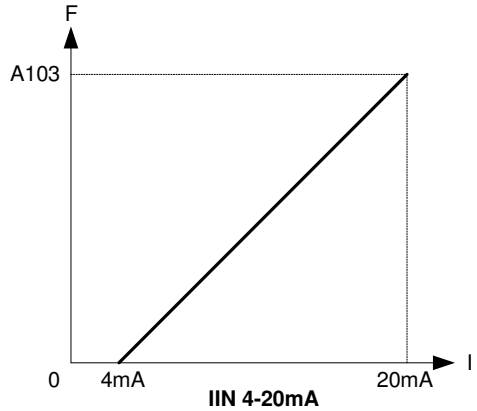
For more information on PID control, refer Mode-C, Group-6 parameters.

13. VIN 0-10V

When this option is selected, the set frequency *M105* corresponds to analog input VIN. The output frequency will be zero at 0V and maximum at 10V.



VIN 0-10V



IIN 4-20mA

14. IIN 4-20mA

When this option is selected, the set frequency *M105* corresponds to analog input IIN. The output frequency will be zero at 4mA and maximum at 20mA.

15. PLC A-O/P 1

When this option is selected, the set frequency *M105* corresponds to PLC A-O/P 1. This Parameter option value can be set directly from In-built PLC function. The output frequency will be zero at 0d and maximum at 100d.

16. PLC A-O/P 2

When this option is selected, the set frequency *M105* corresponds to PLC A-O/P 2. This Parameter option value can be set directly from In-built PLC function. The output frequency will be zero at 0d and maximum at 100d.

17. PLC A-O/P 3

When this option is selected, the set frequency *M105* corresponds to PLC A-O/P 3. This Parameter option value can be set directly from In-built PLC function. The output frequency will be zero at 0d and maximum at 100d.

18. PLC A-O/P 4

When this option is selected, the set frequency *M105* corresponds to PLC A-O/P 4. This Parameter option value can be set directly from In-built PLC function. The output frequency will be zero at 0d and maximum at 100d.

For In-built PLC function and related parameters detail, refer Mode-P.

A107: Local Torque Setting (%)

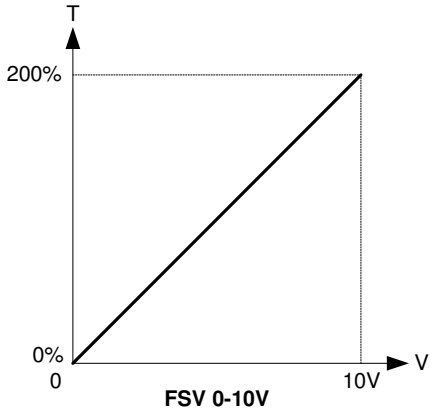
This parameter is available only if motor control mode *A401 = 3, 4* are selected. This is set torque, when torque reference input is ***Local (A108=1)***. The AC DRIVE output frequency (speed) is decided by frequency reference input *A106*. If *A106=1*, then the set frequency is decided by *A101*. In the vector control mode, the frequency reference input is the speed reference.

A108: Torque Reference Input

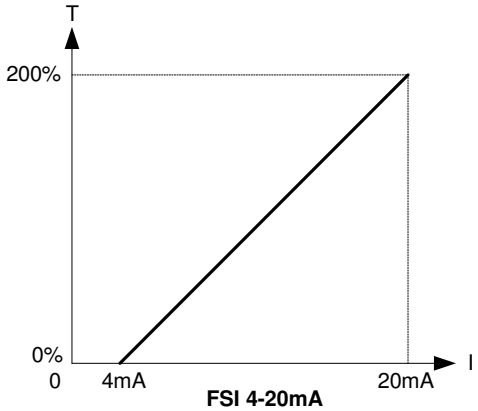
This parameter can be used for torque reference input to the AC DRIVE. The torque reference can be independently selected from the given options even if the AC DRIVE is controlled from local (Digital Operation Panel), terminal or serial. The different torque reference inputs are explained as under. The minimum limit is 0% and maximum limit is 200%, if output current does not exceed *B301* value. In control version 7.02 and thereafter this parameter show 18 selectable option and In control version 3.17 it is show 11 selectable option.

1. Local

When this option is selected, the set torque *M107* corresponds to local set torque *A107*. Use digital operation panel (keypad) to change the set value. The monitor mode parameter *M107* shows the value of local set torque *A107* and *M108* will show keypad as torque reference input. *The local set torque A107 will not have any effect in other options.*



FSV 0-10V



FSI 4-20mA

2. FSV 0-10V

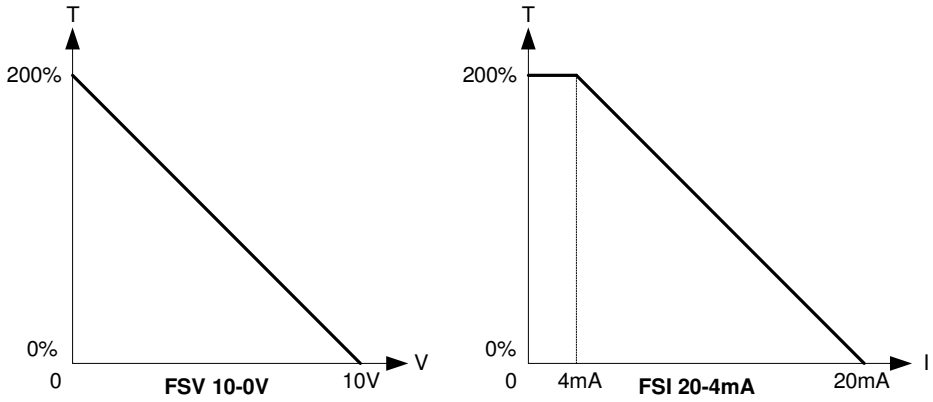
When this option is selected, the set torque *M107* corresponds to analog input FSV. The minimum 0% output torque will be available at 0V and maximum 200% at 10V.

3. FSI 4-20mA

When this option is selected, the set torque *M107* corresponds to analog input FSI. The minimum 0% output torque will be available at 4mA and maximum 200% at 20mA.

4. FSV 0-5V

When this option is selected, the set torque *M107* corresponds to analog input FSV. The minimum 0% output torque will be available at 0V and maximum 200% at 5V.



5. FSI 0-20mA

When this option is selected, the set torque *M107* corresponds to analog input FSI. The minimum 0% output torque will be available at 0mA and maximum 200% at 20mA.

6. FSV 10-0V

This is an inverse to option-2. When this option is selected, the set torque *M107* corresponds to analog input FSV. The Maximum 200% torque will be available at 0V and minimum 0% at 10V.

7. FSI 20-4mA

This is an inverse to option-3. When this option is selected, the set torque *M107* corresponds to analog input FSI. The Maximum 200% torque will be available at 4mA and minimum 0% at 20mA.

8. FSV 5-0V

This is an inverse to option-4. When this option is selected, the set torque *M107* corresponds to analog input FSV. The Maximum 200% torque will be available at 0V and minimum 0% at 5V.

9. FSI 20-0mA

This is an inverse to option-5. When this option is selected, the set torque *M107* corresponds to analog input FSI. The Maximum 200% torque will be available at 0mA and minimum 0% at 20mA.

10. Static potentiometer

When this option is selected, the set torque *M107* will be decided by programmable sequence inputs. Assign one each programmable sequence input to ***Freq Increase*** and ***Freq Decrease*** respectively. When ***Freq Increase*** is applied, the set torque will increase and when ***Freq Decrease*** is applied, the set torque will decrease. If both the signals are applied simultaneously, it will have no effect.

11. Serial

In this option, the set torque *M107* can be assigned from serial link.

The monitor option M107 will display the corresponding set torque value, even if the AC DRIVE is stop

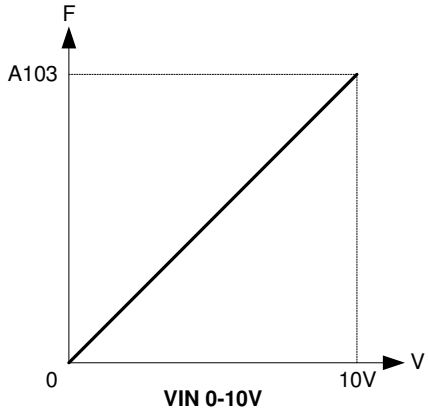
12. PID Output

In this option, the PID output will be the set point. When selecting this input, enable the PID Control.

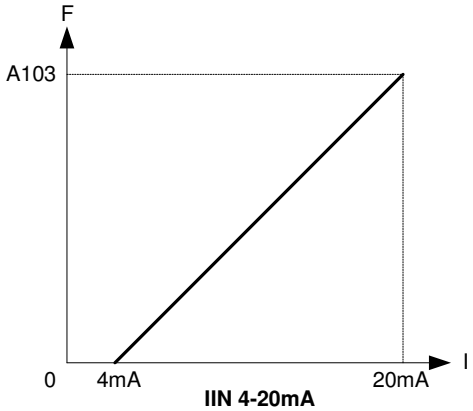
The monitor option M107 will display the corresponding set frequency value, even if the AC DRIVE is stop.

13. VIN 0-10V

When this option is selected, the set frequency *M107* corresponds to analog input VIN. The output frequency will be zero at 0V and maximum at 10V.



VIN 0-10V



IIN 4-20mA

14. IIN 4-20mA

When this option is selected, the set frequency *M107* corresponds to analog input IIN. The output frequency will be zero at 4mA and maximum at 20mA.

15. PLC A-O/P 1

When this option is selected, the set frequency *M107* corresponds to PLC A-O/P 1. This Parameter option value can be set directly from In-built PLC function. The output frequency will be zero at 0d and maximum at 100d.

16. PLC A-O/P 2

When this option is selected, the set frequency *M107* corresponds to PLC A-O/P 2. This Parameter option value can be set directly from In-built PLC function. The output frequency will be zero at 0d and maximum at 100d.

17. PLC A-O/P 3

When this option is selected, the set frequency *M107* corresponds to PLC A-O/P 3. This Parameter option value can be set directly from In-built PLC function. The output frequency will be zero at 0d and maximum at 100d.

18. PLC A-O/P 4

When this option is selected, the set frequency *M107* corresponds to PLC A-O/P 4. This Parameter option value can be set directly from In-built PLC function. The output frequency will be zero at 0d and maximum at 100d.

A109: Extended Parameter

This parameter is used for extend the Mode – E, G, H, P. When this Parameter is Disable then Mode – E, G, H, P are not display. When this Parameter is Enable then Mode – E, G, H, P are display. This is applicable to the control version 7.02 and thereafter.

A110: Frequency Reference Select 1

A111: Frequency Reference Select 2

A112: Frequency Reference Select 3

Use these parameters to select the frequency reference as per the "Reference Select 0" and "Reference Select 1" PSI selection. Refer the PSI selection for further detail.

A113: Stop Frequency

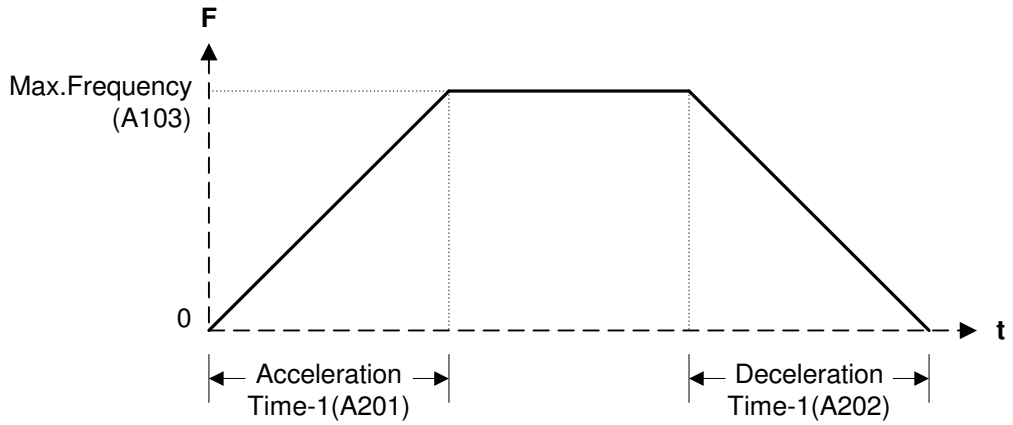
During deceleration drive act as coast to stop at this frequency.

GROUP – 2: ACCELERATION / DECELERATION

A201: Acceleration Time-1 (Sec)

Acceleration Time-1 is the time taken by AC DRIVE output frequency to ramp up from zero frequency to maximum frequency *A103*.

Short acceleration time can result in excessive output current and if it exceeds the acceleration current limit *B303*, the acceleration will cease until the current reduces below the *B303* value. In such case, the actual acceleration time will differ from programmed value. The AC DRIVE may trip in over current fault if the condition persists for long time. Increase acceleration time in such cases.



A202: Deceleration Time-1 (Sec)

Deceleration Time-1 is the time taken by AC DRIVE output frequency to ramp down from maximum frequency *A103* to zero frequency.

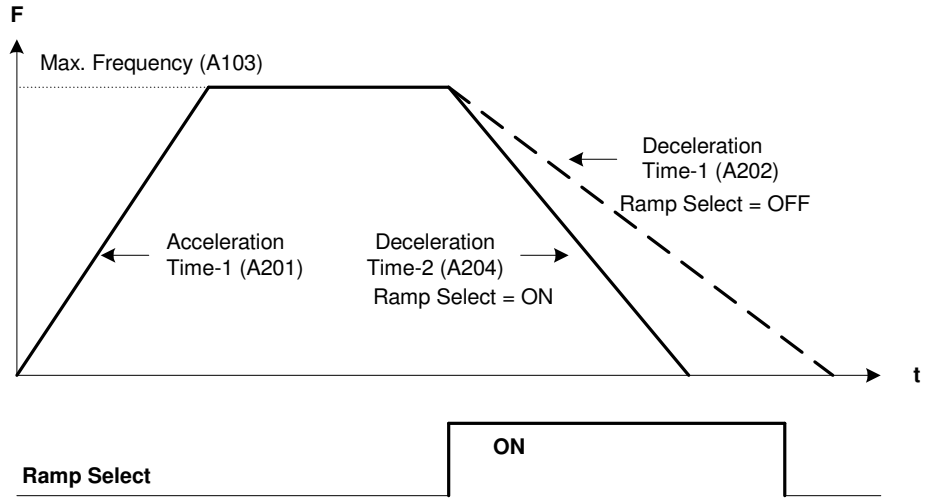
Short deceleration time can result in excessive output current and if it exceeds the stall current limit *B301*, the deceleration will cease until the current reduces below the *B301* value. In such case, the actual deceleration time will differ from programmed value. The AC DRIVE may trip in over current / dc bus over voltage fault if the condition persist for long time. Increase deceleration time in such cases.

A203: Acceleration Time-2 (Sec)

A204: Deceleration Time-2 (Sec)

The Acceleration Time-2 and Deceleration Time-2 can be selected in place of Acceleration Time-1 and Deceleration Time-1. This is valid only if ***Ramp Select*** input is ON. Acceleration Time-2 is the time taken by AC DRIVE output frequency to ramp up from zero frequency to maximum frequency *A103*.

Deceleration Time-2 is the time taken by AC DRIVE output frequency to ramp down from maximum frequency *A103* to zero frequency.

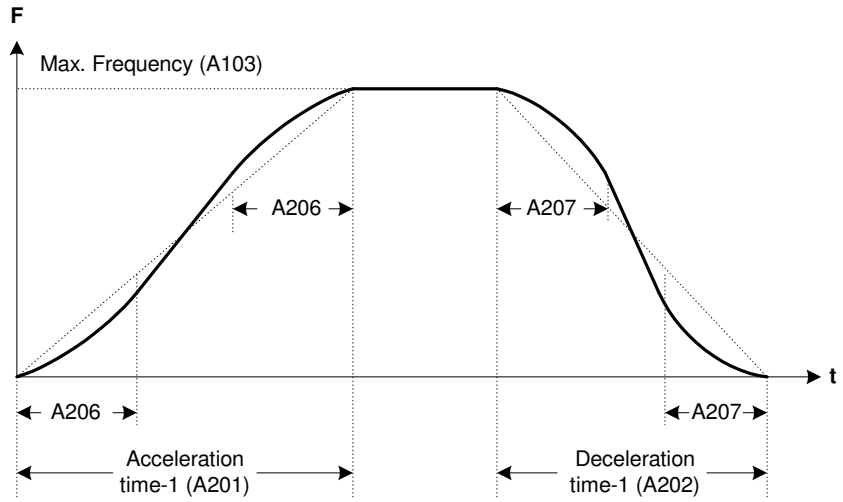


A205: S-Curve Selection

A206: S-Curve Time-1 (Sec)

A207: S-Curve Time-2 (Sec)

Acceleration/deceleration with the S-shape pattern is possible by setting parameter *A205=1*. The higher the S-curve time period, the more pronounced is the S-shape.
The total acceleration / deceleration times will not change.
When this parameter is set, all acceleration and deceleration will be as shown in below fig.
Note: *Set so that the relation of the A206 / A207 setting and acceleration / deceleration time is as shown below.*
A206 / A207 Setting value × 2 ≤ acceleration / deceleration time

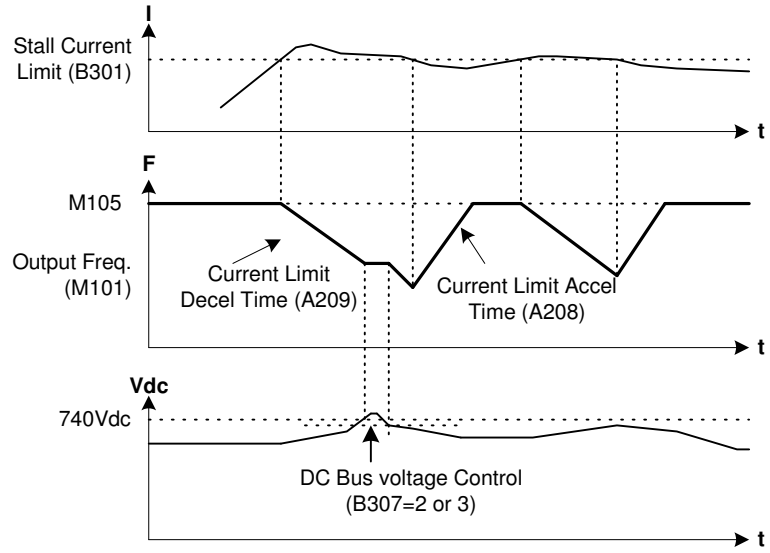


A208: Current Limit Acceleration Time (Sec)

A209: Current Limit Deceleration Time (Sec)

These are the acceleration / deceleration time for the stall current limit function. When the AC DRIVE is operating at set frequency and output current exceeds the stall current limit *B301* value, the output frequency and voltage are reduced. The deceleration time is decided by current limit deceleration time

A209. The dc bus voltage will rise in this process. If DC bus voltage control (*B307= 2 or 3*) is enabled, it will stop the deceleration, if dc bus voltage exceeds 740Vdc level for 400V series. This level is factory settable. The deceleration will resume, if dc link voltage reaches to 710V (hysteresis of 30V) and the output current is still higher than the stall current limit. When the output current falls below the stall current limit, the output frequency and output voltage will ramp up with current limit acceleration time *A208* to set frequency value. The dc bus regulation level for 500V series is 875Vdc and 1050Vdc for 600V series.



A210: Acceleration Deceleration Multiplier

This is multiplier for the acceleration/ deceleration time related parameters. Parameters A201 ~ A207 and D206 ~ D207 will be multiplied by this multiplier and the effective values of these parameters will be the result of this multiplication.
For example, if A201=10 second and A210=10, then the effective value of A201=100 second.

GROUP – 3: START / STOP SELECTION & DC BRAKING

A301: Start Control

The AC DRIVE can be started from *Local* (Digital Operation Panel), *Terminal* or *Serial* irrespective of the frequency reference input. However, the direction will be decided as per the start control selection only. When the start control is *Local*, the direction can only be changed through Digital Operation Panel. The same applies to other selections also.

If in running condition, start control is changed from *Local* to *Terminal*, the operation will continue as per the status of the new selection. For example, present selection is *Local*. Now if in running condition, the selection is changed to *Terminal.* If *RUN* signal is present in terminal mode, the AC DRIVE will continue running. If *RUN* signal is absent, the AC DRIVE will stop. When the selection is changed from *Terminal* to any other mode (*Local* or *Serial*), AC DRIVE will continue its operation as per the status of *Terminal* and not as per the new selection (*Local* or *Serial*).

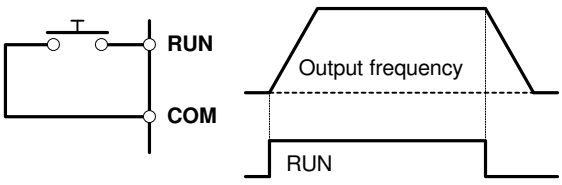
The drive will accept the stop from Terminal only, if A301=2 (Terminal) is set. It will not stop from Local (Digital Operation Panel) or Serial.

The drive will accept the stop from local (Digital Operation Panel) or Serial if A301=1 or 2 is set. In this case, the drive will not stop from Terminal.

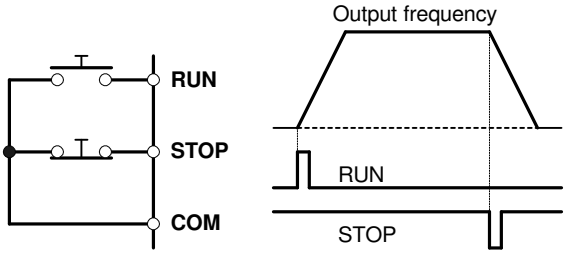
A302: Maintained Start / Stop

When using Terminal as start control (*A301=2*), this parameter gives the choice of having maintained or momentary contacts for start or stop.

If *A302=0*: The start / stop control is maintained type as described in below figure.



If *A302=1*: The start / stop control is momentary type as described in below figure.



A303: Start Delay Time (Sec)

The motor will be delayed start from the run command by the set time. This is used for synchronization with peripheral machines such as mechanical brakes. The start command can be from Digital Operation Panel (keypad), Terminal or Serial.

The start delay time is also applicable to *Jog Select* input.

A304: Stop Mode

This parameter allows the user to select the stop mode. If *A304=0* selected, the output will ramp down to stop with deceleration time after the stop command and then applying the dc brake (if programmed) to stop. If *A304=1* selected, the output will be turned off simultaneously with the stop command. The dc braking will not be applicable in this mode. The motor will stop depending on its inertia.

When stop key is pressed for 2.5 seconds or longer during operation, the drive will coast to stop regardless of Local or Terminal start control.

To restart after coast to stop, confirm that the motor has stopped. The AC DRIVE may trip if attempted when the motor is running. (Enable the speed search function in such applications.)

A305: Motor Direction

This parameter allows the user to set the motor direction, when Start control selection is local (Digital Operation Panel) *A301=1*. Set *A305=0*, to rotate the motor in forward direction and *A305=1* to rotate the motor in reverse direction in Local mode.

When *A301=2: Terminal*, the direction of rotation is determined by the status of programmable sequence input.

Set B308 to prevent unintentional reverse direction operation. When enabled it will prevent the unit to start in reverse direction. This parameter cannot be changed during running condition.

Note: *If reverse direction is locked and run command is given with reverse direction selection, the unit will not start in reverse direction.*

A306: DC Brake Start Frequency (Hz)

This is the frequency at which the dc brake will be applied. To enable this feature, the stop mode should be ramp down and the dc braking time should not be zero. ***If dc braking time is zero, this feature will be disabled.***

A307: DC Brake Current (%)

This parameter decides the dc brake current.

A308: DC Brake Time (Sec)

This parameter decides the length of time for which dc braking is on.

When the stop mode is ramp down and stop command is issued, the output will ramp down with deceleration time. When the AC DRIVE output reaches to dc braking start frequency, the dc voltage is injected to the motor. The amount of voltage and the length of time for which it is applied are decided by the dc braking current *A307* and *A308* respectively.

The dc braking is utilized to stop high inertia load forcefully. During dc braking mechanical energy trapped in rotor due to system inertia will be dissipated as heat in the motor. Hence for safety dc breaking is utilized at lower frequency.

A309: Stall Current Limit Selection

This parameter provides the choice for the selection of the stall current limit either from *Local* or *Terminal.*

When the stall current limit selection is *Local*, the stall limit comes from the parameter *B301* and if selection is terminal then comes from analog input VIN (0-10V). It's range from 0 to 200% according to 0-10V at VIN.

GROUP – 4: V / F CHARACTERISTICS

A401: Control Mode

Set the required motor control mode. This Parameter does not change by default Load in B311. In control version 7.02 and thereafter this parameter show 8 control mode option and In control version 3.17 and thereafter it is 5.

A401=1: The motor control mode is V/F Open loop Heavy duty Control.

A401=2: The motor control mode is V/F Close-loop Heavy duty Control.

A401=3: The motor control mode is Sensor-less Heavy duty Vector Control.

A401=4: The motor control mode is Close-loop Heavy duty Vector Control.

A401=5: The motor control mode is V/F Open loop Normal duty Control

A401=6: The motor control mode is V/F Close-loop Normal duty Control

A401=7: The motor control mode is Sensor-less Normal duty Vector Control

A401=8: The motor control mode is Close-loop Normal duty Vector Control

A402: V/F Selection

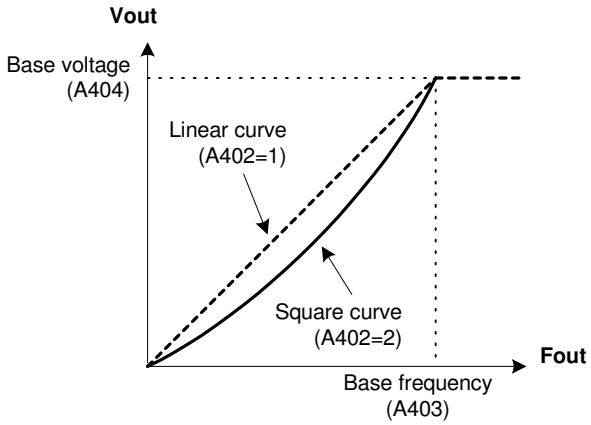
Select appropriate v/f curve as per the application.

The AC DRIVE can be operated in linear curve mode, Square curve or custom setting mode.

In a linear curve mode, the v/f curve will be linear through out the range from minimum frequency to Base frequency.

In square curve, the v/f curve will be square as shown in the figure. Fan and pump application require additional energy conservation on variable torque/ horsepower loads due to reduced output v/f at lower frequencies. So that Fan and pump loads can be programmed with $X=Y^2$ law.

The custom mode setting allows the user to set different v/f points on characteristic curve using parameters *A403 ~ A410*.



A403: Base Frequency (%)

This is output frequency up to which the v/f is maintained constant. The unit operates in constant torque mode up to this point and thereafter changes to constant horsepower mode. The maximum output voltage at this point can be set with base voltage *A404*. This is percentage of Motor Frequency *B105*.

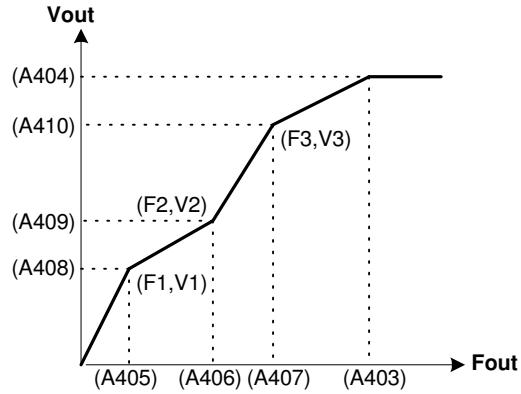
A404: Base Voltage (%)

This parameter sets the maximum output voltage when the output frequency reaches to base frequency as set in parameter *A403*. The voltage set is percentage of motor voltage *B102*.

A405 ~ A407: V/F1 ~ 3 Frequency (%)

A408 ~ A410: V/F1 ~ 3 Voltage (%)

Custom three-point v/f characteristics as shown in the below figure can be set for the motors having special v/f characteristics. Choose custom v/f curve in *A402*.



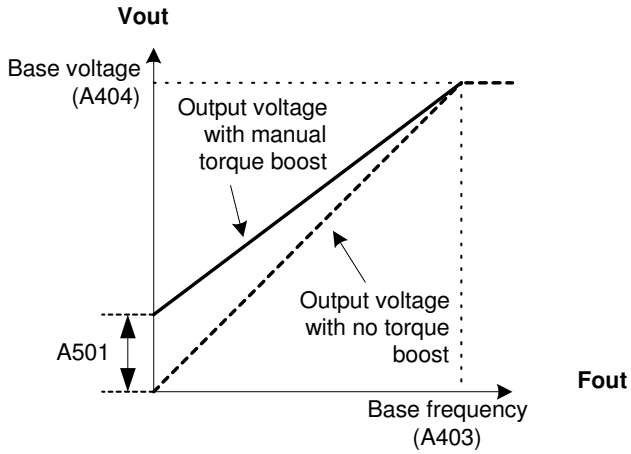
Set so that F1 (*A405*) ≤ F2 (*A406*) ≤ F3 (*A407*) and V1 (*A408*) ≤ V2 (*A409*) ≤ V3 (*A410*).
A405~A407 are percentage of *A403* and *A408~A410* are percentage of *A404*.

GROUP – 5: TORQUE BOOST

A501: Manual Torque Boost setting (%)

When setting manually, set the boost voltage at 0Hz as a percentage in respect to the Motor voltage (*B102*). When programmed to zero, it will be disabled.

When automatic torque boost is selected, manual torque boost setting will not be valid regardless of the manual torque boost selection state.



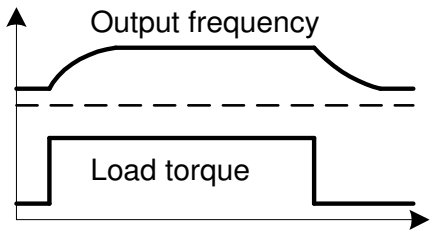
A502: Automatic Torque Boost selection

When automatic torque boost is selected, manual torque boost setting will not be valid regardless of the manual torque boost selection state.

The automatic torque boost function carries out voltage boosting using the current detection value. This allows the torque to be improved when starting and at low speed regions.

A503: Slip Compensation (Hz)

Set motor's rated slip. When setting manually, set the slip frequency for the motor rated load in respect to the base frequency. The output frequency changes according to the motor rated torque. The output frequency will respond with a time constant of approximately 500msec in respect to the change in the load torque.



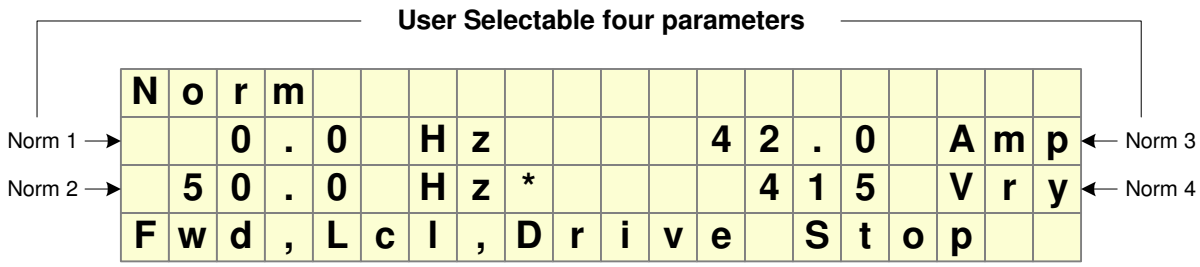
GROUP – 6: DISPLAY PARAMETER SELECTION

A601 ~ A608: Normal parameter 1 ~ 8

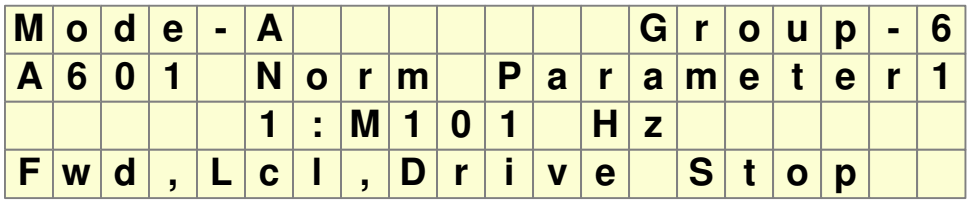
A601: It selects parameter wishing to display on normal screen position *Norm-1* out of M101~M105, M109~M110, M115~M115, M201~M208, M211 and M217 of monitor mode.

Similarly A602~A608 selects parameters for *Norm-2* to *Norm-8* positions.

The default setting will be as under.

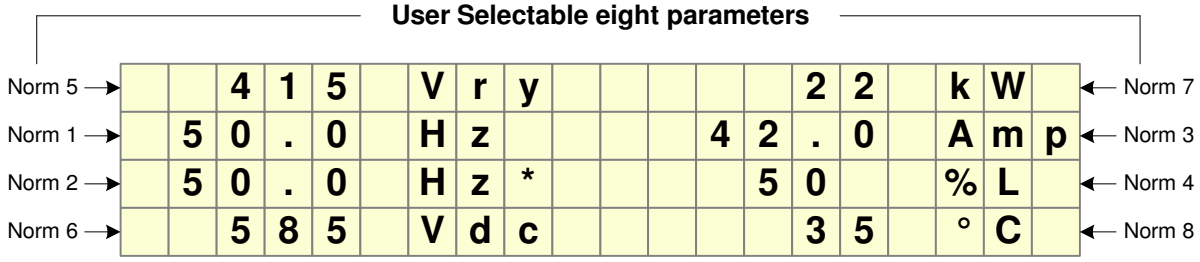


To display the Output Frequency M101 (Hz) parameter at *Norm 1* position as shown in the above screen, select option 1 (M101 Hz) in parameter A601 Norm Parameter1.



Similarly, to display the desired parameters at positions Norm 2, Norm 3 and Norm 4, select the appropriate option in A602, A603 and A604 respectively.

Parameters A605~A608 selects parameters for *Norm-5* to *Norm-8* positions for the meter screen and are not applicable for the normal screen. Below is the meter screen with eight parameters.



GROUP – 7: FREQUENCY REFERENCE MATH OPERATIONS

A701: Multipler-A106

This is a multiplier to the frequency reference selected in A106.

A702: Math Reference Input2

Select the second reference for the math operation from the below options. In control version 7.02 and thereafter this parameter show 9 selectable option and In control version 3.17 and thereafter it is 5 selectable option.

=1: Not Used
=2: FSV 0-10V
=3: FSI 4-20mA
=4: VIN 0-10V
=5: IIN 4-20mA
=6: PLC A-O/P 1
=7: PLC A-O/P 3
=8: PLC A-O/P 2
=9: PLC A-O/P 4

A703: Multipler-A702

This is a multiplier to the math reference input2 selected in A702.

A704: Math Operator

Select the mathematical operation to be carried out between frequency reference selected in *A106* and math reference input2 selected in *A702* from the following options.

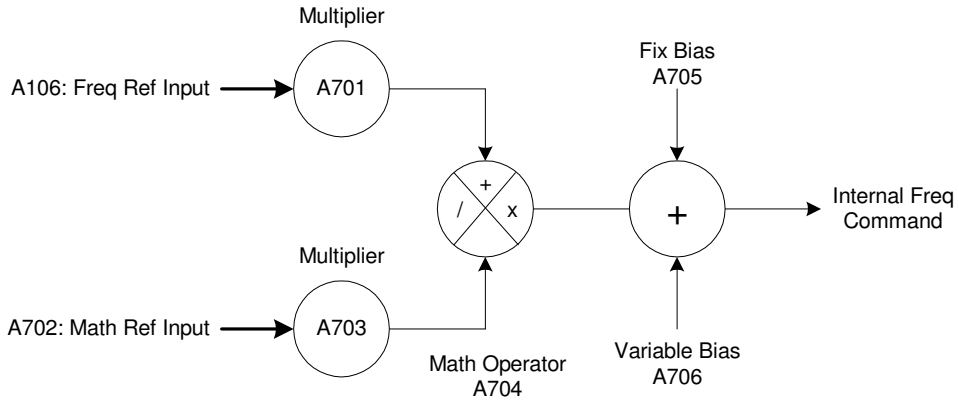
=1: + Add
=2: x Multiply
=3: / Divide

A705: Fix Bias (Hz)

This is fixed bias added into the output after the math operation.

A706: Variable Bias

This parameter can be used to add variable bias into the output after the math operation. Select from the below options.
=1: Not Used
=2: FSV 0-10V
=3: FSI 4-20mA
=4: VIN 0-10V
=5: IIN 4-20mA
=6: Static Pot



MODE – B

GROUP – 1: MOTOR PARAMETERS

B101: Rated Input Voltage (Vac)

Select suitable rated input voltage for the AC DRIVE. When the rated input voltage is changed, the motor voltage may change accordingly.

B102: Motor Voltage (Vac)

Enter motor nameplate voltage. This is used as reference voltage for many parameters. This is the motor terminal voltage during full load at the base frequency.

B103: Motor Current (Amp)

Enter motor rated current from the motor nameplate. This is full load motor current at base frequency. The timed over current and other current related protections are based on this value. This value cannot be set higher than AC DRIVE rated current *M305*.

B104: Motor Frequency (Hz)

Enter motor base frequency from the motor nameplate. Base frequency *A403* should be set in accordance to the motor frequency.

B105: Motor Speed (rpm)

Enter motor base speed from the motor nameplate. When higher than this speed, the flux control during vector control will be weakened.

B106: Motor Output Rating (kW)

Enter motor capacity from the motor nameplate.

B107: Motor Poles

Enter motor poles from the motor nameplate.

B108: No Load output Voltage (Vac)

Enter the motor terminal voltage during no load at the base speed. It will be automatically set if auto-tuning function is executed.

B109: Encoder Pulses (P/R)

Enter the encoder pulses from the encoder specification. This is used when the motor control mode in *A401=2, 4.*

B110: Carrier Frequency (kHz)

This is the carrier frequency of the pwm. Set in accordance to the rated capacity of the AC DRIVE. If set higher than the specified carrier frequency, derate the output current accordingly.

B111: DTC Gain

This is gain for the dead time compensation. Adjust incase of motor hunting.

B112: kW without VFD (kW)

Enter the power consumption in kW before *Axpert-Eazy* variable frequency drive is installed. This is used to calculate the energy saving with VFD.

B113: Currency Selection

Select the currency of the energy cost. The money saved using VFD is displayed in this currency.

B114: Energy Cost

Enter the energy cost here. This is used to calculate the money saved using VFD.

Note: *Parameters B115 to B117 are not applicable to standard VFD and applicable only when the function is enabled in factory parameters and the unit is provided for the variable voltage fix frequency source.*

B115: Local Set Voltage (%)

Enter the output voltage in % of Motor voltage B102. This is applicable only when the unit is configured to use as variable voltage fix frequency power supply.

B116: Output Voltage Reference Selection

Use this parameter to select the output voltage reference input.

When Local is selected, the output voltage is set using B115.

B117: Encoder Polarity

This is used to select Encoder polarity.
= 0: Forward
= 1: Reverse

GROUP – 2: MOTOR CONSTANT

B201: Automatic Tuning selection

This parameter allows the user to select the automatic tuning process. Select appropriate option for the automatic tuning for the selected motor control mode.

B202 & B203: Primary Resistance R1 (mΩ)

The motor circuit constant is set. This value is decided by mantissa section *B202* and exponent section *B203* as below. R1 = Value of B202 x (10^ value of *B203)* [mΩ].

For example, if B202= 0.200 and B203= 2, the value of R1= 0.200 x 10^2 = 0.200 x 100 = 20 mΩ

B204 & B205: Secondary Resistance R2' (mΩ)

This is the secondary resistance (rotor resistance) of induction motor.

B206 & B207: Leakage Inductance L (mH)

This is the value of leakage inductance of the induction motor.

B208 & B209: Excitation Inductance M' (mH)

This is the value of excitation inductance of the induction motor.

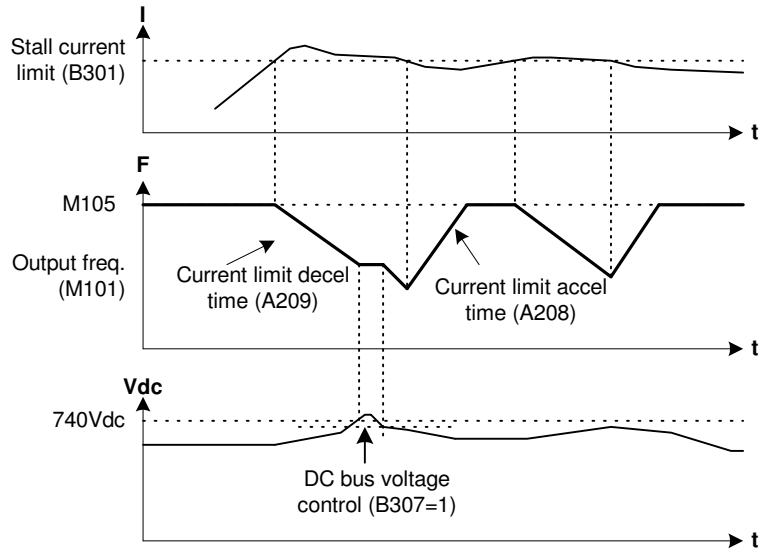
B210 & B211: Iron Loss resistance Rm (mΩ)

These parameters *(B202 ~ B206)* are related to motor's internal distributed parameters. They are useful for auto torque boost application. During auto tuning mode these parameters are automatically calculated.

GROUP – 3: PROTECTION PARAMETERS

B301: Stall Current Limit (%)

When the AC DRIVE output current crosses the stall current limit, the output ramps down with Current limit deceleration time *A209*. This is effective only when the AC DRIVE is operating at set speed. This feature is not active while the AC DRIVE is accelerating or decelerating. When the current decreases below the programmed value, the AC DRIVE again starts accelerating to the set speed with Current limit acceleration time *A208*. This feature helps in maintaining relatively constant output torque characteristics.



Set the current limit as a percentage of motor rated current.

When local is selected in *A309*: Stall Current Limit Selection, *B301* will be effective. When terminal is selected, stall current limit is set by the 0-10V analog signal at VIN. Its range is from 0 to 200% according to 0-10V at VIN.

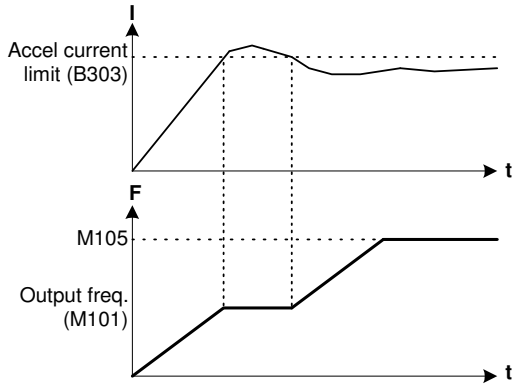
B302: Adjustable Over Current Level (%)

Set the upper current limit as a percentage of motor rated current. Whenever the AC DRIVE output current exceeds the set value, the AC DRIVE trips indicating Adjustable over current fault. Always set higher side to prevent the unnecessary tripping of the AC DRIVE during normal operation. This gives the user to program the current level below the standard inverse time curve. This may be used in cases where excessive torque shocks can lead to a harmful effect on the machinery.

Set to 300% to disable this function. The standard inverse time trip remains in effect.

B303: Acceleration Current Limit (%)

This is acceleration current limit and effective only during normal acceleration. It stops the acceleration during acceleration, if the motor current exceeds the programmed value. When the



current reduces below the programmed value, the AC DRIVE again starts accelerating to the set speed. This feature helps in preventing over current tripping of high inertia load during fast acceleration.

B304: Under Current Level (%)

This feature trips the AC DRIVE when the current falls below the programmed value for more than 1sec after the speed reaches its set speed. This feature is not active while the AC DRIVE is accelerating or decelerating. Making this 0 will disable this.

Note: *In pump applications, if the flow decreases below a minimum speed there will be cavitations. This feature becomes useful to turn off the pump in such case.*

B305: Overload Setting (%)

This is reference for the inverse time overload characteristics. Changing this parameter can change the inverse time overload characteristics. The setting uses motor rated current as 100%.
The available over load is 150% for 60 seconds inverse time characteristics. Note that if 155% of the rated current is exceeded, a trip will occur at the 160% for 10 seconds and at 170% for 4 seconds.

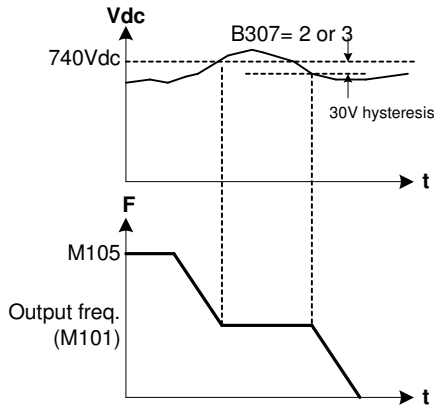
B306: Earth (Ground) Fault Detection Level (%)

This parameter sets the earth (ground) fault detection level. When the vector sum of all the 3-phase current is more than the set limit, the unit will trip in earth (ground) fault. Set to zero to disable the earth (ground) fault protection.

Note: *The internal earth (ground) fault protection function is to protect the unit against earth (ground) faults in the motor and the motor cable. This is not a personal safety or a fire protection feature. The earth (ground) fault protective function can be disabled setting B306 to zero.*

B307: DC Bus voltage Control

When enabled, it will prevent the over voltage during RUN condition. Refer below figure for the functioning of dc bus voltage control. The deceleration will cease, if dc bus voltage is >740V. It will resume only after the dc bus voltage reduces to 710V (30V hysteresis). In this case actual deceleration time will be more than the programmed deceleration time. The dc bus regulation level for 500V series is 875Vdc and 1050Vdc for 600V series.



B308: Reverse Direction Lock

Set this to prevent unintentional reverse direction operation. When enabled it will prevent the unit to start in reverse direction. This parameter cannot be changed during running condition.

Note: *If reverse direction is locked and run command is given with reverse direction selection, the unit will not start in reverse direction.*

B309: Parameter Lock

This is user programmable 4-digit password to prevent unintentional parameter change from the digital operation panel. When programmed, it will not allow the user to change any parameter from digital operation panel or serial link except Local Set Frequency *A101 (or D201)*, Local Torque Reference *A107*, PID Reference Setting *C611* and terminal functions. ***The unit will be shipped without any password protection.*** To lock the parameters, first enter your selected 4-digit password in *B310* and then enter any value other than your selected password to *B309*. The parameters will be locked and cannot be changed (except the set frequency). Now, to open the lock, enter the selected password to *B309.* If you have entered correct password, you will have the access of all parameters. Now you can change the parameters, even the password. To lock the parameters again follow the same thing.

B310: Change Password

This parameter is used to change the 4-digit user password for parameter locking.

B311: Default value Load

Custom Parameter Save

When set to 111, current parameters will be saved to the non-volatile memory for the future use. This feature is extremely useful for the custom default.

Custom Parameter Default

When set to 222, all the parameters will be set to custom saved parameters saved using 111.

Default Load as per US standard

When set to 333, default value will be loaded as per the US standard in all the parameters. However, this will not change the factory setting parameters, user password, C211 to C218 and B202 to B211. Following parameters will be different than the general default.
A101, A103, B104, D103, D201, D203 = 60.00Hz
B101, B102, D101 = 460V
B105, D104 = 1800rpm

General Default Load

When set to 444, default value will be loaded in all the parameters. However, this will not change the factory setting parameters, user password, C211 to C218 and B202 to B211.

Fault History Clear

When set to 555, the fault history buffer is cleared. No previous fault code and parameter will be available.

Full Default Load

When set to 666, all the parameters will be set to default condition including C205 to C218 and B202 to B211. However, this will not change the factory setting parameters and user password.

Full Default Load

When set to 777, all the PLC parameters will be set to default.

Note that the value entered in B310 will not be memorized. If correct value is entered, appropriate action will be taken and “00” will be displayed. If incorrect value is entered, no action will be taken and “00” will be displayed.

B312: 0Hz Overload Setting (%)

B313: 0.7*BF Overload Setting (%)

For the self-cooling type motor, when operating at low speed, set these parameters to meet the motor characteristics.
B312 is valid from 0.10Hz to 1.00Hz.
B313 is valid from >1.00Hz to 0.7*Base Frequency
B305 is valid from >0.7*Base Frequency

Note that B312<=B313<=B305

B314: Output Current Unbalance Level (%)

Set the unbalance current level for the output. When the current unbalance exceeds the set level, the unit will trip. Set to 0% to disable the function.

B315: Copy Parameter Set

This parameter is used for the Copy all parameters to the Display EEPROM from control side, Display used as Pen Drive. User can copy 5 sets of all parameters. This is applicable to the control version 7.02 and thereafter. The following options are

=0: Enter Copy Set
=1: Copy Set 1
=2: Copy Set 2
=3: Copy Set 3
=4: Copy Set 4
=5: Copy Set 5

B316: Paste Parameter Set

This parameter is used for the Paste all parameters to the control side from Display EEPROM, Display used as Pen Drive. User can paste 5 sets of all parameters. This is applicable to the control version 7.02 and thereafter.The following options are

=0: Enter Paste Set
=1: Paste Set 1
=2: Paste Set 2
=3: Paste Set 3
=4: Paste Set 4
=5: Paste Set 5

GROUP – 4: PRESET SPEED

B401 ~ B407: Preset Speed 1 ~ 7 (Hz)

This is frequency setting for different preset speeds. The drive supports eight different speeds that can be set by three programmable sequence input using parameters *C101 ~ C105*. The following preset speed can be selected with the sequence input commands ***Preset i/p-0***, ***Preset i/p-1*** and ***Preset i/p-2***. Set desire frequencies in *B401 ~ B407*. When no sequence input is present, the set frequency will be decided by the Frequency reference input *A106*.

Preset i/p-2	Preset i/p-1	Preset i/p-0	Speed Selected
OFF	OFF	OFF	Normal Speed Reference (*A106*)
OFF	OFF	ON	Preset Speed 1 (*B401*)
OFF	ON	OFF	Preset Speed 2 (*B402*)
OFF	ON	ON	Preset Speed 3 (*B403*)
ON	OFF	OFF	Preset Speed 4 (*B404*)
ON	OFF	ON	Preset Speed 5 (*B405*)
ON	ON	OFF	Preset Speed 6 (*B406*)
ON	ON	ON	Preset Speed 7 (*B407*)

The *Start Control A301* determines the direction of rotation. If *Local* (Digital Operation Panel) is selected as start control, the direction can be change only through parameter ***A305***. When *Terminal* is selected as start control, the status of sequence input terminal would decide the direction.
The preset speed can be set higher than max frequency *A103* up to 600Hz. However, the output frequency will not exceed the maximum frequency *A103*.

GROUP – 5: SKIP FREQUENCY

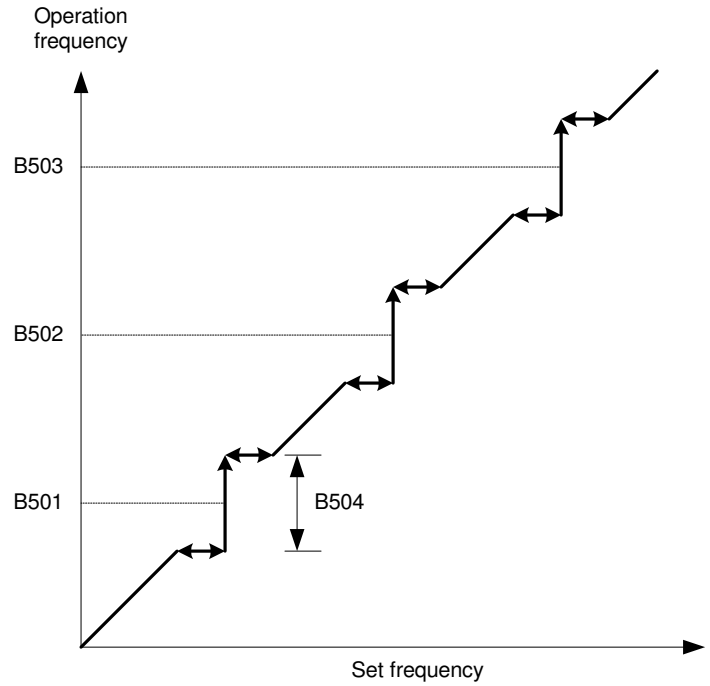
B501: Skip Frequency 1 (Hz)

B502: Skip Frequency 2 (Hz)

B503: Skip Frequency 3 (Hz)

B504: Skip Frequency 4 (Hz)

If the equipment being driven has problems due to mechanical resonance at some frequencies, the same can be jumped over by programming them in parameters *B501 ~ B503*. The AC DRIVE output settles for top or the bottom of the skip band, the one being closest to the desired speed. This is only applicable during normal operation of the AC DRIVE. During acceleration or deceleration this parameter will not function.



GROUP – 6: VECTOR CONTROL CONSTANTS-1

B601: **Speed Loop Time (mS)**

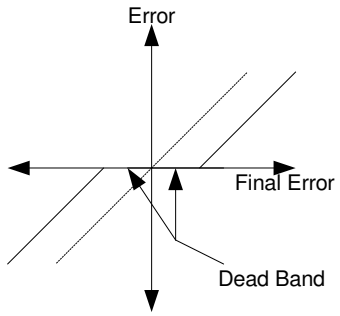
It is a time at which the speed control loop will execute. This parameter is used to adjust the speed control loop bandwidth.

B602: **ASR P-Action Control (%)**

If the speed setting value or motor speed changes suddenly, this will prevent sudden change in the output of proportional control of ASR.

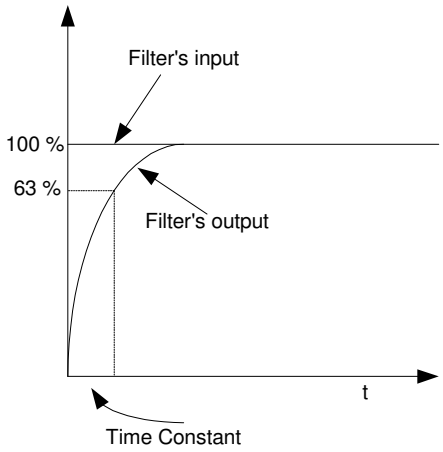
B603: **ASR Dead Band (%)**

This represents non-sensitive range of ASR's input. If the speed error is less than this value than it will be considered as zero error. This is in percentage of maximum frequency.



B604: **Speed LPF Time Constant (mS)**

It is time constant of filter for speed feedback to the ASR.



B605: **ASR Kp**

It is proportional constant for ASR. If we ignore the Integral action than at any time the ASR's output will be Kp times the error at that time. To increase the speed response, set a large value. Note that if the value is too high the actual speed will hunt.

B606: **ASR Ti (Sec)**

It is Integral time for ASR. If Kp=1 and Error=100% than ASR's output will be 100% within this time. The Integral constant Ki is given by,

$$Ki = Kp/Ti$$

To increase the speed response, set a small value. Note that if the value is too low then the actual speed will hunt.

B607: **ASR Drive Torque Limit (%)**

In motoring mode it will limit the quadrature current component (torque current).

B608: **ASR Regenerative Torque Limit (%)**

In regenerative mode it will limit the quadrature current component.

B609: **Speed Estimation Kp**

This is a proportional gain for the adaptive speed estimation. To increase the speed estimation response, set large value. Note that if the value is too high the speed estimation value will hunt.

B610: **Speed Estimation Ti (Sec)**

This is an Integral time constant for the adaptive speed estimation. To increase the speed estimation response, set low value. Note that if the value is too low the speed estimation value will hunt.

B611: **Over Speed Protection Level (%)**

This is the over speed protection level. When the detection speed is equal to or higher than the set level for 50msec, the unit will trip in over speed fault. Set as a percentage of Max. Frequency.

B612: **Speed Deviation Level (%)**

This is the speed deviation level. A speed deviation error occurs when the speed command and speed detection difference is higher than the set level for 200ms. Set as a percentage of Max. Freq.

B613: **Machine Time Constant (mS)**

The time to accelerate the motor and load's torque inertia to the base speed at the rated torque is set.

B614: **Acceleration Machine Bias (%)**

This is add fixed bias in speed PID output during acceleration.

B615: **Deceleration Machine Bias (%)**

This is add fixed bias in speed PID output during deceleration.

GROUP – 7: VECTOR CONTROL CONSTANTS-2

B701: **Torque Mode Selection**

When this mode is active, the prime parameter to be control is Torque instead of Speed. This mode is applicable in case of open-loop vector control mode only.

B702: **Excitation Current Reference (%)**

It is excitation current reference. It is almost equal to no load motor current.

B703: **Torque LPF Time constant (mS)**

It is time constant of the filter for the torque current feedback to the ACR.

B704: **ACR Kp**

It is proportional constant for ACR. If we ignore the Integral action than at any time the ACR's output will be Kp times the error at that time. To increase the current response, set large value. Note that if the value is too low or too high then the current will hunt.

B705: **ACR Ti (mS)**

It is Integral time for ACR. If Kp=1 and Error =100%, ACR output will be 100% within this time. The Integral constant Ki is given by,

$$Ki = Kp/Ti$$

To increase the speed response, set small value. Note that if the value is too low or too high then the current will hunt.

B706: **ACR Q Upper Limit (%)**

This is the ACR Q-Controller output upper limit.

B707: **ACR Q Lower Limit (%)**

This is the ACR Q-Controller output lower limit.

B708: **ACR D Upper Limit (%)**

This is the ACR D-Controller output upper limit.

B709: **ACR D Lower Limit (%)**

This is the ACR D-controller output lower limit.

B710: **Torque Reference Polarity (%)**

This is used to select Torque reference polarity
=0: Unipolar
=1: Bipolar

MODE – C

GROUP – 1: PROGRAMMABLE INPUT / OUTPUT SELECTION

C101 ~ C106: PSI-1 ~ 6

C114 ~ C115: PSI-RUN~STOP

User can configure eight programmable sequence inputs for different functions using parameters *C101 ~ C106 and C114 ~ C115*. The status of the *Programmable Sequence Input* can be monitored in *M307*. The various options are explained as under. In control version 7.05 and thereafter these parameters show 36 selectable PSI option and In control version 3.17 and thereafter this parameters show 23 selectable PSI option.

OPTION	FUNCTION NAME	FUNCTION
1	***Not Used***	Indicates that no function is selected on the PSI.
2	***Jog Select***	This is a jog command. If this signal is ON while RUN is OFF, operation then conforms to the setting of jogging speed. For stoppage, either ramp down stop or coast to stop is available.
3	***Ramp select***	Acceleration / Deceleration ramp performance is switched over. Acceleration / Deceleration Time-2 is available with ON, and Acceleration / Deceleration Time-1 is available with OFF.
4	***Preset i/p-0***	The Preset Speed 0~7 are selected as per the binary combination of the Preset i/p-0 ~ 2.
5	***Preset i/p-1***	
6	***Preset i/p-2***	
7	***Freq Increase***	The currently selected frequency setting is increased or decreased. When the ON state continues, the frequency is incremented /decremented with 0.1Hz at every 100msec. This is valid only if static potentiometer is selected as frequency reference source in *A106*
8	***Freq Decrease***	
9	***Aux Drive***	The auxiliary drive setting is validated with this signal. This operation is valid during the AC Drive stopping.
10	***Emergency stop – NO***	This is used as emergency stop. This is Normally Open type. When the digital input (connected to COM in case of sink logic or to +24V in case of source logic) is Close, Emergency stop occurs as per the selection in C503.
11	***Fault Reset***	This is used for the fault reset. If *RUN* input is present at the time of fault reset, the AC Drive will not start after fault reset. *Issue fresh RUN command to start the AC Drive after fault reset.*
12	***Ext Fault - NO***	This is used for the external fault function. This is Normally Open type. When the digital input (connected to COM in case of sink logic and to +24V in case of source logic) is Close, external fault occurs.
13	***Reverse***	This input is used to select reverse direction of rotation in terminal mode. ***Note that this will not function when RSF and PR function are selected in E101.***
14	***Terminal***	When this input is selected, the operation control will be switched over to terminal.
15	***Ref Select 0***	These two inputs are used to select the frequency reference as shown in the side table.
16	***Ref Select 1***	

Ref Select 1	***Ref Select 0***	**Freq reference**
0	0	*A106*
0	1	*A110*
1	0	*A111*
1	1	*A112*

17	***PR Step Skip***	When this input is selected, it will skip the present step during Pattern Run operation. Only applicable to Pattern Run function.
18	***PR Step Hold***	When this input is selected, it will hold the present step during Pattern Run operation. Only applicable to Pattern Run function.
19	***PR/RSF Reset***	When this input is selected, it will reset the present Pattern Run operation or Ring Spinning Frame Operation. Only applicable to Pattern Run & Ring Spinning Frame functions.
20	***PID Bypass***	This is used to bypass the PID controller. When this input is selected, the PID Reference input will be PID Output and there will not be any effect of PID controller.
21	***PID Disable***	This is used to disable the PID controller. When this input is selected, the PID Output will remain to the last value and there will not be any effect of PID Reference or PID Feedback on the PID Output.
22	***Emergency stop – NC***	This is used as emergency stop. This is Normally Close type. When the digital input (connected to COM in case of sink logic or to +24V in case of source logic) is open, Emergency stop occurs as per the selection in C503.
23	***Ext. Fault - NC***	This is used for the external fault function. This is Normally Close type. When the digital input (connected to COM in case of sink logic and to +24V in case of source logic) is open, external fault occurs.
24	***Run***	This is used to give RUN command from terminal.
25	***Stop***	This is used to give STOP command from terminal.
26	***Drive Enable - NO***	This is used for the “Enable” function. It allows drive output when RUN command is given. When “Enable” is not active, output will not come even though RUN command is present. This is Normally open type. When link (connected to COM in case of sink logic and to +24V in case of source logic) is closed, “Enable” function activates.
27	***Drive Enable - NC***	This is used for the “Enable” function. It allows drive output when RUN command is given. When “Enable” is not active, output will not come even though RUN command is present. This is Normally Closed type. When link (connected to COM in case of sink logic and to +24V in case of source logic) is open, “Enable” function activates.
28	***PLC input 1***	Option 28 ~ 35 are PLC input are use to read PSI status from Inverter to In-built PLC.
29	***PLC input 2***	
30	***PLC input 3***	
31	***PLC input 4***	
32	***PLC input 5***	
33	***PLC input 6***	
34	***PLC input 7***	
35	***PLC input 8***	
36	***Torque Mode***	When this input is selected the unit will work in torque mode. This is applicable only in vector control mode.

The default selection is as under.

TERMINAL	OPTION	NAME
PSI1	2	***Jog Select***
PSI2	10	***Emergency stop***
PSI3	11	***Fault Reset***
PSI4	4	***Preset i/p-0***
PSI5	5	***Preset i/p-1***
PSI6	6	***Preset i/p-2***

RUN	24	***RUN***
STOP	25	***STOP***

C107 ~ C110: PSO-1 ~ 4

User can configure four programmable sequence outputs for different functions using parameters *C107 ~ C110*. The status of the *Programmable Sequence Output* can be monitored in *M308*. The various options are explained as under. In control version 7.02 and thereafter these parameters show 32 selectable PSI option and In control version 3.17 and thereafter these parameters show 24 selectable PSI option.

OPTION	NAME	FUNCTION
1	***Not Used***	No function is selected.
2	***Run***	This turns ON during running, jogging or DC braking.
3	***Local***	This turns ON when the operation mode is local (operation from the digital operation panel is selected).
4	***Reverse Run***	This turns ON when the motor is reverse running.
5	***I-Detection***	This turns ON when the output current reaches the programmed I-Detection Level *C302* or higher.
6	***Freq Attain***	This turns ON when the output frequency (speed) reaches the set frequency (speed). The detection reach width is set with frequency attainment detection width *C301*.
7	***Speed Detect1***	This turns ON when the output frequency (speed) value reaches a speed higher than the speed set with the detection level –1.
8	***Speed Detect2***	This turns ON when the motor speed reaches a speed higher than that set in the detection level-2.
9	***Acceleration***	This turns ON during acceleration.
10	***Deceleration***	This turns ON during deceleration.
11	***Aux Drive***	This turns ON when the auxiliary drive parameter setting is validated by the sequence input AUXDV.
12	***Timer Output***	This turns ON during running, jogging, pre-excitation and DC braking. A programmable off delay (*C309*) is provided, so even if the above operations turn OFF, this control will not turn OFF for programmed time. This is used for external fan/ motor control.
13	***Zero Speed***	This turns ON when the output frequency (speed) value is below the level set with zero speed level.
14	***Fault Alarm***	This output is ON when minor fault alarm is detected.
15	***PID Up Limit***	The output will be activated when the PID output reaches to the programmed upper limit value.
16	***PID Lo Limit***	The output will be activated when the PID output reaches to the programmed lower limit value.
17	***Temp Alarm***	The output is ON when the heat sink temperature exceeds the set Temperature Alarm Level in C311
18	***Ready***	The output is ON when the unit is ready to start. The soft charge contactor is energized and no fault condition persists.
19	***Pump-1***	This is applicable to Multi-pump function only. The output turns ON, when the respective pump is ON.
20	***Pump-2***	
21	***Pump-3***	
22	***Pump-4***	
23	***Doff-End Alarm***	This turns ON only at the point going back the set time (*E105*) from the moment auto stop occurs after completion of the final step when performing spinning frame operation.

24	***Sleep Mode***	This turns ON when the unit is in sleep mode.
25	***Fault***	The output is ON when fault occurs.
26	***PLC Output 1***	Option 26~32 are use to write PSO status from In-built PLC to Inverter. This is explained in In-built PLC Function explanation.
27	***PLC Output 2***	
28	***PLC Output 3***	
29	***PLC Output 4***	
30	***PLC Output 5***	
31	***PLC Output 6***	
32	***PLC Output 7***	
33	***PID F/B ULmt***	The output will be activated when the PID feedback reaches to the programmed upper limit value.
34	***PID F/B LLmt***	The output will be activated when the PID feedback reaches to the programmed lower limit value.

The default setting of the programmable sequence outputs are as under.

TERMINAL	OPTION	NAME
PSO1	2	***Run***
PSO2	6	***Freq Attain***
PSO3	1	***Not Used***
PSO4	1	***Not Used***

C111 ~ C112: Programmable Relay-1 ~ 2

C113: Programmable Fault Relay

User can configure two programmable relays for different functions using these parameters. The status of the *Programmable Relay* can be monitored in *M308*. The options are same as PSO.
The default settings are as under. C113 is only applicable in control version 7.02 and thereafter.

RELAY	OPTION	NAME
Programmable Relay-1	2	***Run***
Programmable Relay-2	1	***Not Used***
Programmable Fault Relay	25	***Fault***

GROUP – 2: ANALOG OUTPUT SELECTION

C201 ~ C202: Vout-1 ~ 2

User can configure two programmable analog outputs (0~10V) for different functions using parameters *C201 ~ C202*. In control version 7.02 and thereafter these parameters show 11 selectable options and in control version 3.17 and thereafter these parameters show 9 selectable options.

OPTION	NAME	FUNCTION
1	***Output Freq***	The analog output will correspond to the output frequency (0~A103).
2	***O/P Current***	The analog output will correspond to the output current (0~200%).
3	***Output Power***	The analog output will correspond to the output power (0~B106).
4	***Output Volt***	The analog output will correspond to the output voltage (0~100%).
5	***DC Bus Volt***	The analog output will correspond to the dc bus voltage (0~800).
6	***PID Output***	The analog output will correspond to the PID Output (0~100%)

7	***Heat sink Temp.***	The analog output will correspond to the heat sink temp. (0~100 °C)
8	***PLC A-O/P 1***	The analog output will correspond to the PLC A-O/P 1 (0~100d).
9	***PLC A-O/P 2***	The analog output will correspond to the PLC A-O/P 2 (0~100d).
10	***PLC A-O/P 3***	The analog output will correspond to the PLC A-O/P 3 (0~100d).
11	***PLC A-O/P 4***	The analog output will correspond to the PLC A-O/P 4 (0~100d).
12	***Unipolar Torque Current***	The analog output will correspond to the torque current (0~200%).
13	***Excitation Current***	The analog output will correspond to the excitation current (0~200%).
14	***Set Frequency***	The analog output will correspond to the Set frequency (*M105*).
15	***Bipolar Torque Current***	The analog output will correspond to the torque current (-200~200%).

The default setting of the programmable analog outputs are as under.

TERMINAL	OPTION	NAME
VO1	1	***Output Freq***
VO2	2	***O/P Current***

C203 ~ C204: Iout-1 ~ 2

User can configure two programmable analog outputs (4~20mA) for different functions using these parameters. The options are same as above.

The default setting of the programmable sequence outputs are as under.

TERMINAL	OPTION	NAME
IO1	3	***Output Power***
IO2	4	***Output Volt***

C205: Vout-1 Gain

This is gain setting for the VO1 analog output.

C206: Vout-2 Gain

This is gain setting for the VO2 analog output.

C207: Iout-1 Gain

This is gain setting for the IO1 analog output.

C208: Iout-1 Bias

This is bias setting for the IO1 analog output.

C209: Iout-2 Gain

This is gain setting for the IO2 analog output.

C210: Iout-2 Bias

This is bias setting for the IO2 analog output.

C211: FSV Gain

This is gain setting for the FSV analog input.

C212: FSV Bias

This is bias setting for the FSV analog input.

C213: FSI Gain

This is gain setting for the FSI analog input.

C214: FSI Bias

This is bias setting for the FSI analog input.

C215: VIN Gain

This is gain setting for the VIN analog input.

C216: VIN Bias

This is bias setting for the VIN analog input.

C217: IIN Gain

This is gain setting for the IIN analog input.

C218: IIN Bias

This is bias setting for the IIN analog input.

C219: FSV / FSI Time Constant (mS)

This parameter sets the filter time constant for the FSV and FSI analog inputs.

C220: VIN / IIN Time Constant (mS)

This parameter sets the filter time constant for the VIN and IIN analog inputs.

C221: vout-1 bias

This parameter is bias setting for the analog output voltage vo1. This is applicable to the control version 7.02 and thereafter.

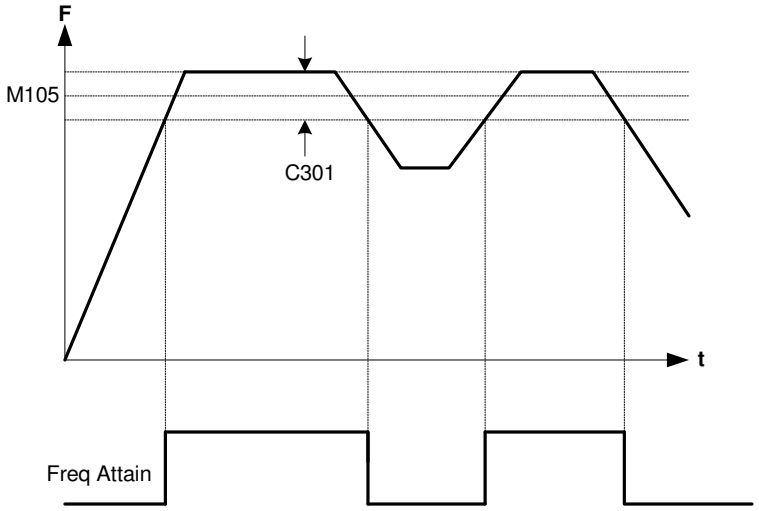
C222: Vout-2 Bias

This parameter is bias setting for the analog output voltage vo2. This is applicable to the control version 7.02 and thereafter.

GROUP – 3: STATUS OUTPUT DETECTION LEVEL

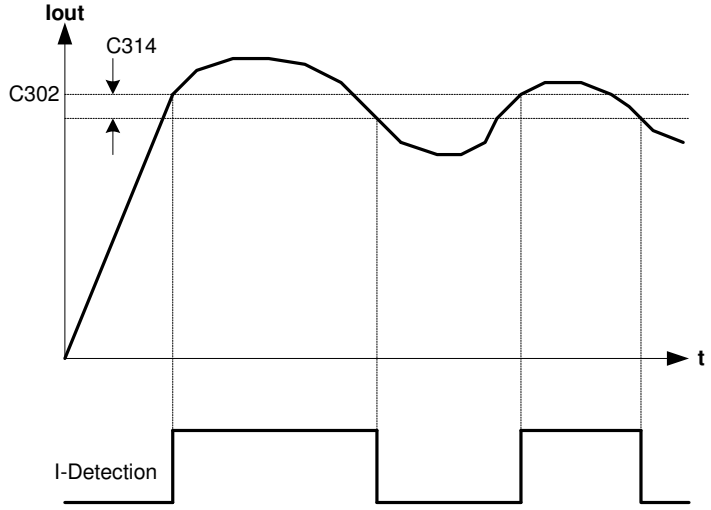
C301: Frequency Attainment detection Width (%)

The frequency output attained operation width is set using this parameter as % of maximum frequency *A103*. If ***Freq Attain*** option is selected for the PSO and relay outputs in parameter *C106 ~ C111*, the output is enabled when the output frequency attains the set frequency. The width of the attainment detection is decided by the programmed value in *C301* as explained in below figure. The output remains high even if drive recent frequency deviates above or below set frequency by Attainment width. Set with a percentage to the maximum frequency *A103*.



C302: I-Detection (current detection) Level (%)

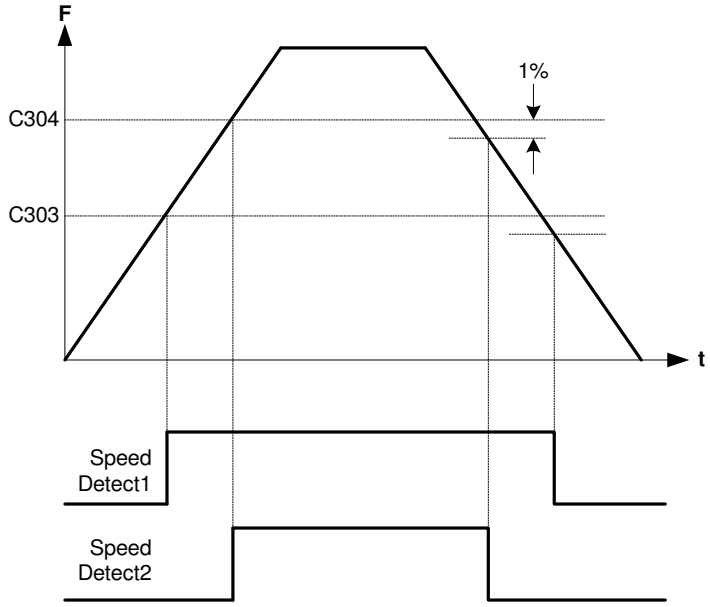
The I-Detection (current detection) level is set. Set with a percentage of the rated current *(B103)*. A hysteresis (Set in C314) will occur with the I-Detection operation, which means the output will be off only when the output current drops below the Current detection level by the % value in C314. The state of the ***I-Detection*** programmable sequence output is shown in the below figure.



C303: Speed Detection Level – 1 (%)

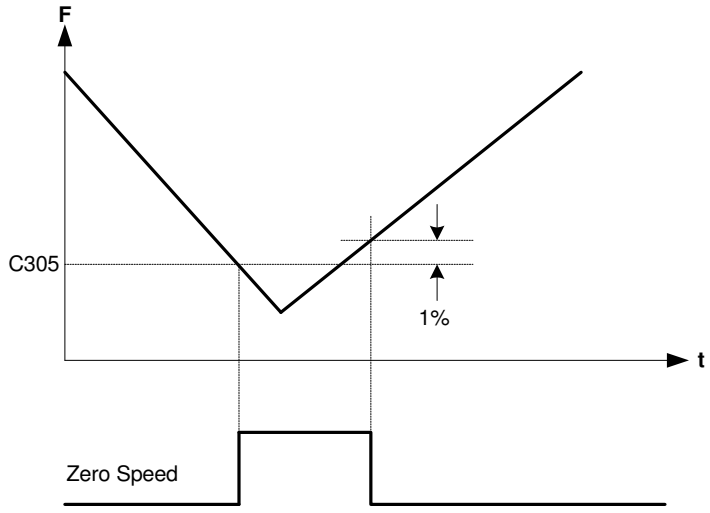
C304: Speed Detection Level – 2 (%)

The speed detection operation level is set. Set with a percentage to the maximum frequency *A103*. The output frequency or the motor speed will be the comparison target. When the output frequency reaches the set level, the output will be ON. When the frequency reduces below the 1% hysteresis level, the output will be OFF.



C305: Zero Speed Detection Level (%)

The Zero speed detection operation level is set. Set with a percentage to the maximum frequency *A103*. The output frequency or the motor speed will be the comparison target. A 1% hysteresis will occur with zero speed operation. The status of ***Zero Speed*** programmable sequence output is as under.



C306: 4-20mA Reference Loss

This parameter configures the AC DRIVE's response to a failure or fault of the 4-20mA frequency reference input signal. The various options are as under.
1: No action at fault detection
2: Minor fault alarm and run at Minimum Speed
3: Minor fault alarm and run at Maximum Speed
4: Minor fault alarm and run at set speed
5: Minor fault alarm and run at preset speed-1
6: Fault, ramp down to stop
7: Fault, coast to stop

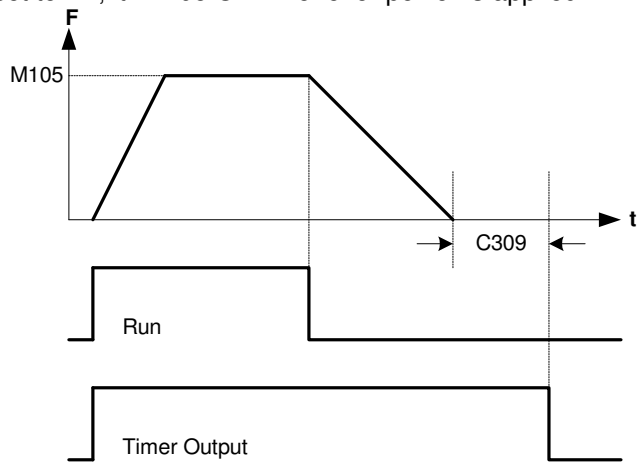
C307: Output Phase Loss Selection

When enabled, AC DRIVE will trip in the following condition. If the output current of any one phase is <5% and the other two-phase current is >70% (factory set) of motor rated current for five cycles. This

fault will not occur during speed search operation. It can be disabled using *C307.* ***Note that this fault will not occur if the output terminals are open circuit.***

C308: Timer Output Control Selection

This parameter decides the status of the ***Timer Output*** option of the programmable sequence output. When set to "0", the programmable sequence output will be ON only when AC DRIVE is ON. When set to "1", it will be ON whenever power is applied.



C309: Timer Output Off Delay Time (Sec)

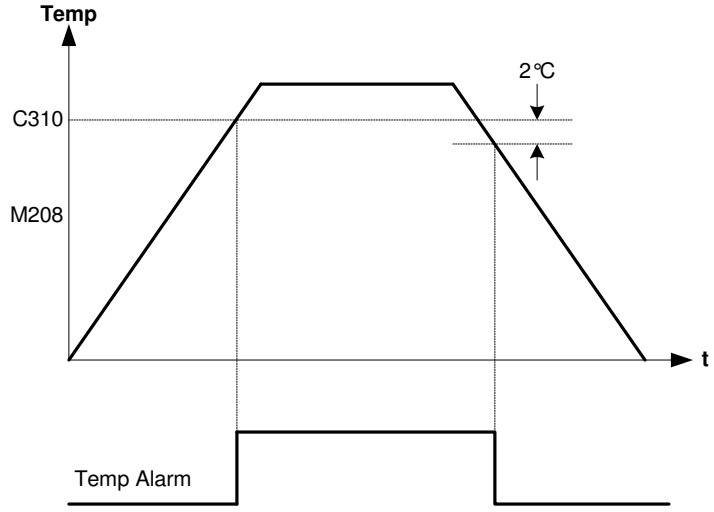
This parameter is applicable if timer output control selection is "0". This is the delay time in turning off the programmable sequence output after the AC DRIVE is off. Set the time in seconds.

C310: Temperature Control selection

This parameter controls the automatic change of the carrier frequency in case of temperature rise above 82°C level. When enabled, the carrier frequency will be automatically reduced to control the heat sink temperature. Once the frequency is reduced, it will only be increased if the heatsink temperature reduces below 67°C.

C311: Temperature Alarm Level (°C)

This is temperature alarm level set point. Whenever the heat sink temperature exceeds the set value, the Temp Alarm output will be set. Hysteresis of 2°C hysteresis will occur with temperature alarm.



C312: In- built PLC Selection ①/
: Input Phase Check ②

① For Control version 7.02 and onwards, this parameter is used to enable the In-built PLC function.

② For Control version 3.17 and onwards, this parameter is used to enable or disable the Input phase check function.

C313: Static Pot Options

This parameter provides selection of the static pot speed at power up to the user.
The following options are
=1: Last speed
=2: Min frequency (A102)
=3: Max frequency (A103)
=4: A101 Set frequency
=5: B401 Preset speed-1

C314: I-Detection Hysteresis Level

This parameter sets the hysteresis level for I-Detection operation

GROUP – 4: SERIAL COMMUNICATION

C401: Baud Rate (bps)

Drive is facilitating with serial communication between drive unit and computer terminal. To control or monitor single/ multiple units from single computer terminal, serial link can be used. This parameter defines Baud rate (number of signal transition per second, it can be number of bits per second). The available options are as under. Option-4 is set as default baud rate.

1: 1200 bps	4: 9600 bps
2: 2400 bps	5: 19200 bps
3: 4800 bps	6: 38400 bps

Refer the detail manual for the ModBus protocol and other information.

C402: Station Number

This parameter defines the address of the unit when connected to the serial network. This AC DRIVE supports the ModBus protocol. The station number can be assigned to 1 ~ 247.

C403: Parity

This parameter is used to set the parity. Parity is error-checking code to prevent from erroneous data transformation between drive unit and terminal.

C404: Response Time (Sec)

Set the minimum time from receiving the command to returning an answer.

C405: Operation Panel Communication Loss selection

Enable or disable the operation panel communication loss fault. If enabled, AC DRIVE will generate fault if it does not receive any response from the operation panel within 100msec. By default setting, this fault is disabled.

For detail information on the ModBus protocol and register assignment, please refer "Serial Communication Guide, Version 1.1".

Note: *Put jumper JP3 to "LD" position to use terminating resistors. Remove the cover designated as "Control Unit" to access this jumper on PCA-2014A/PCA-2004A.*

GROUP – 5: AUTO RESTART & SPEED SEARCH

C501: Number Of Restart

C502: Restart wait Time (Sec)

Restart is function to reset the fault in the AC DRIVE and restart automatically to continue operation if a fault occurs. User can select these parameters to automatically restart the unit in fault condition to provide reliability and continuity of process during fault conditions.

Programming 0 in *C501* disables the restart feature. Number of restart *C501* defines the number of attempts to restart during the fault condition.

When a fault is detected, the AC DRIVE output is shut off for the restart wait time *C502*. The operation panel displays the fault while the AC DRIVE output is OFF.

When the restart wait time elapses, a fault is reset automatically and speed search operation is performed.

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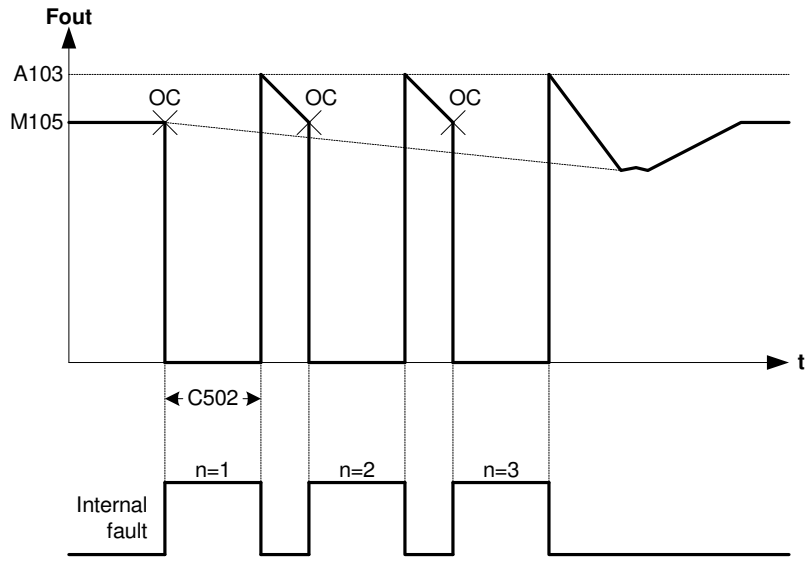
When the number of such attempts exceeds the number of restart *C501*, the faults are not reset automatically and the AC DRIVE output remains OFF. At this time a fault relay is activated and the fault data will be stored in fault history. The RUN relay will also be deactivated.



The number of restart times is cleared to 0 in the following cases.
1. A fault does not occur for more than 10 minutes.
2. A fault reset signal is applied from the operation panel or terminal.
3. The power supply is turned off and turned ON again.

This function is applicable to the following ten faults.

1. Instantaneous over current fault.
2. Timed over current fault.
3. Over voltage fault.
4. Under voltage fault.
5. Adjustable over current fault.
6. Earth fault.
7. Over temperature fault.

8. Under current fault.
9. External fault.
10. Phase loss fault.

C503: Emergency Stop mode

Set the stopping method for the emergency stop from the following options.

1. Coast to stop without fault output
2. Coast to stop with fault output
3. Ramp down to stop

C504: Speed Search selection

C505: Speed Search Current Limit (%)

C506: Speed Search Frequency Deceleration time (Sec)

C507: Speed Search Voltage Acceleration time (Sec)

C508: Speed Search Wait Time (Sec)

Speed search operation is useful to start the coasting motor or AC DRIVE changeover operation without tripping. When selected, the AC DRIVE starts speed search from the maximum frequency. The operation starts after the speed search wait time *C508* after the start command. The following figure explains the sequence of operation.

Speed search current limit *C505* is applicable only during the speed search operation. The output frequency deceleration time and output voltage acceleration time during the SSF can be adjusted using *C506* and *C507* respectively as per the application.

C509: PLCT Time (Sec)

Power Loss Carry Through is a function that allows the AC DRIVE to run trip-less during the short-term power outage / under voltage. As soon as the power outage / under voltage is detected, the AC DRIVE output is turned OFF. If the supply resumes before the programmed time in *C509*, the AC DRIVE will start with the speed search operation and reach to the set frequency. The fault relay will not be enabled during this process nor the under voltage fault displayed on the operation panel. However, if the power outage or under voltage condition persists for longer time than the programmed time, the AC DRIVE will trip indicating under voltage fault. When programmed to 0, the PLCT feature is disabled.

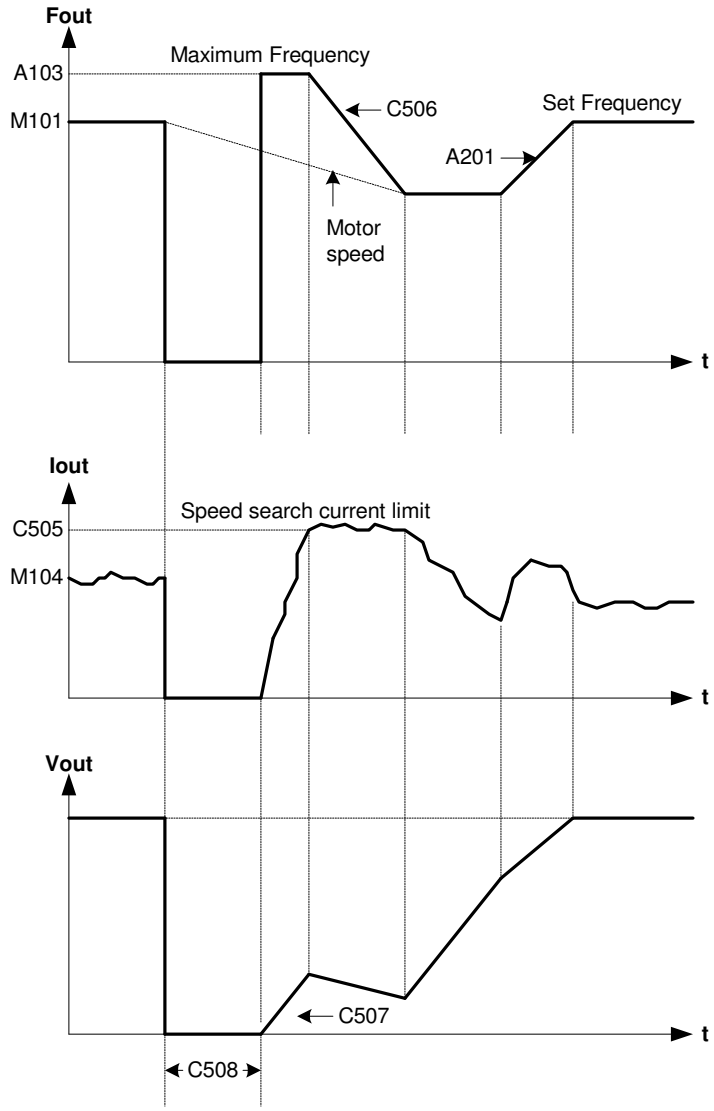
Note: *The time in C509 must be less than the time for which the control power supply remains stable during the power outage or under voltage condition.*

C510: Speed Search Match Current Limit (%)

Speed search match current limit function limit drive current when speed match with actual motor speed. Not usually necessary to set. When restarting is not possible with the factory settings, set the value.

C511: Speed Search Match Frequency Gain

Set gain to increase the frequency after speed detect for speed search function.



SPEED SEARCH FUNCTION

GROUP – 6: PID CONTROL SELECTION

C601: PID Control Selection

The AC DRIVE provides one inbuilt PID controller, which can be used to change the AC DRIVE output frequency or can be utilized as stand alone module. This parameter is used to validate the PID operation. When PID is used to control the speed of the AC DRIVE, select ***PID Output*** as frequency reference in *A106*. The PID output can also be selected for the analog output. This will be useful when using PID control block as stand alone module.

C602: PID Polarity

This parameter can be used to invert the output of PID as per the system requirement.

C603: PID Reference Input

The PID reference input can be selected from any of the six options. The various options include ***FSV 0-10V, FSI 4-20mA, Vin 0-10V, Iin 4-20mA, Local***, ***Serial, PLC A-O/P 1, PLC A-O/P 2, PLC A-O/P 3*** **and** ***PLC A-O/P 4***. The value of selected PID reference input is displayed in *M109 in %*. In control

version 7.02 and thereafter this parameter show 10 selectable options and in control version 3.17 this parameter show 6 selectable options.

C604: PID Feedback Input Selection

The PID feedback input can be selected from any of the four options. The various options include ***FSV 0-10V, FSI 4-20mA, Vin 0-10V, Iin 4-20mA, PLC A-O/P 1, PLC A-O/P 2, PLC A-O/P 3 and PLC A-O/P 4***.. The option selected for the PID reference input cannot be selected for the PID feedback input. The value of selected PID feedback input is displayed in *M110 in %*. In control version 7.02 and thereafter this parameter show 8 selectable options and in control version 3.17 and thereafter this parameter show 4 selectable options.

C605: Proportional Gain

This parameter is used to set the proportional gain for the P-control. Setting to zero does not perform P-control.

C606: Integral Time (Sec)

This parameter is used to set the integral time for the I-control. Setting to maximum value does not perform I-control.

C607: Derivative Gain

This parameter is used to set the derivative gain for the D-control. Setting to zero does not perform D-control.

C608: PID deviation Upper Limit (%)

This is the upper limit for the PID output deviation. If the programmable sequence output ***PID Up Limit*** is selected, the output will be ON, when the PID output reaches to this level.

C609: PID deviation Lower Limit (%)

This is the lower limit for the PID output deviation. If the programmable sequence output ***PID Lo Limit*** is selected, the output will be ON, when the PID output reaches to this level.

C610: PID Offset Adjustment (%)

Sets offset for the output after PID control.

C611: PID Reference Setting (%)

When ***Local*** is selected as PID reference, this parameter is used to set the PID reference using digital operation panel. This parameter will not have any effect if other options are selected as reference.

C612: PID Display Scale - Max

Use this parameter to scale the PID signals in terms of process parameters. This is used only for the display purpose and will not have any effect on the operation. Unit display as per C614.
Set this to the max value of the process parameter feedback sensor and will correspond to 10V.

C613: PID Display Scale - Min

Use this parameter to scale the PID signals in terms of process parameters. This is used only for the display purpose and will not have any effect on the operation. Unit display as per C614.
Set this to the min value of the process parameter feedback sensor and will correspond to 0V.

C614: PID Display Unit Selection

Select appropriate unit for the process variable.

C615: Sleep Mode Selection

When the sleep mode is selected, the inverter output is switched OFF, if the frequency reference (or PID output) remains below the sleep mode enter frequency (*C616*) for the set time period (*C617*). Sleep mode can be used with or without PID control.

C616: Sleep Mode Enter Frequency (Hz)

This is the frequency used to activate the sleep mode and turn off the inverter. This is the frequency at which the drive will enter in sleep mode.

C617: Sleep Mode Active Delay (Sec)

The inverter output will be turned off if the frequency reference (or PID output) remains below sleep mode enter frequency (*C616*) for the set sleep mode active delay time.

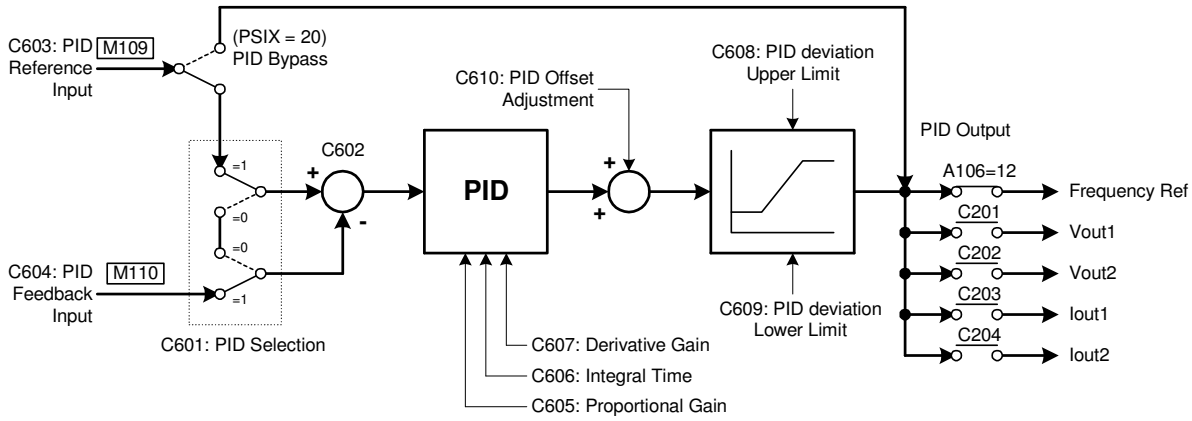
C618: Sleep Mode Wake Up Band (%)

This is to prevent from rapid on/off of the drive. This is set with respect to the max frequency (*A103*) and used as hysteresis when leaving the sleep mode. The inverter will be turned on when the frequency reference (or PID output) exceeds the sleep mode enter frequency (*C617*)+ wake up band (*C618*).

C619: Sleep Mode Leave Condition

This parameter defines the sleep mode leave condition. There are two conditions to wake up from the sleep mode as below.

1. Freq Ref > C616 Sleep Mode Enter Freq + Wake Up Band
2. Freq Ref > A102 Min Freq + Wake Up Band



PID Controller

GROUP – 7: PLC PANEL PARAMETER

Note: *This group is only available in Control version 7.02 and onwards.*

C701 to C702: PLC Panel Par1 to 2

This PLC panel parameter 1 & 2 are used in-built PLC for Timer 1 application. Related memory location of this parameter is from 101 to 102.

C703 to C704: PLC Panel Par3 to 4

This PLC panel parameter 3 & 4 are used in-built PLC for Timer 2 application. Related memory location from of this parameter is 103 to 104.

C705 to C706: PLC Panel Par5 to 6

This PLC panel parameter 5 & 6 are used in-built PLC for Timer 3 application. Related memory location from of this parameter is 105 to 106.

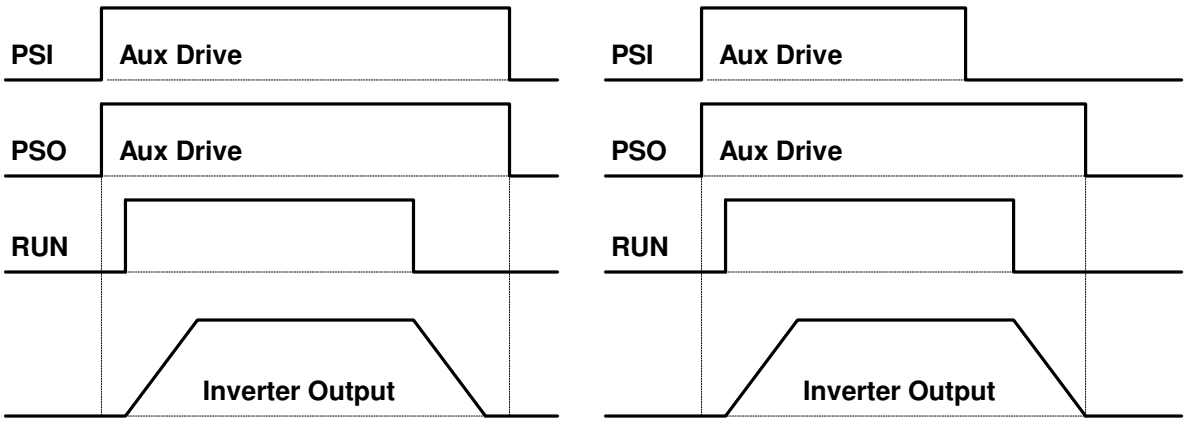
C707 to C708: PLC Panel Par7 to 8

This PLC panel parameter 7 & 8 are used in-built PLC for Timer 4 application. Related memory location from of this parameter is 107 to 108.

C709 to C712: PLC Panel Par9 to 12

PLC panel parameter 9 to 12 can be input and used in-built PLC application. Related memory location of this parameter is from 109 to 112.

MODE – D: AUXILIARY DRIVE PARAMETERS



GROUP – 1: MOTOR PARAMETERS

D101: Motor Voltage (Vac)

Enter motor nameplate voltage of ***auxiliary drive***. This is used as reference in the software. This is the motor terminal voltage during full load at the base frequency.

D102: Motor Current (Amp)

Enter motor rated current from the ***auxiliary motor*** nameplate. This is full load motor current at base frequency. The timed over current and other current related protections are based on this value. This value cannot be set higher than AC DRIVE rated current *M305*.

D103: Motor Frequency (Hz)

Enter motor base frequency from the ***auxiliary motor*** nameplate. Base frequency *A403* should be set in accordance to the motor frequency.

D104: Motor Speed (rpm)

Enter motor base speed from the ***auxiliary motor*** nameplate. When higher than this speed, the flux control during vector control will be weakened.

D105: Motor Output Rating (kW)

Enter motor rated capacity from the ***auxiliary motor*** nameplate.

GROUP – 2: FREQUENCY SETTING

D201: Local Set Frequency (Hz)

This is the set frequency for ***auxiliary drive*** when the frequency reference input source is **local (*A106=1*)**. The output will ramp to this frequency, when start command is given.

The minimum limit for this parameter is decided by minimum frequency *D202*. If *D202* is set higher then *D201*, the value of *D202* is automatically assigned to *D201*.

The maximum value of this parameter is decided by Maximum frequency *D203*. The value of *D201* cannot be set higher than *D203*.

D202: Minimum Frequency (Hz)

This is the minimum output frequency of the AC DRIVE when ***auxiliary drive*** is selected.

In terminal mode, this is the minimum output attained with minimum analog input reference. This value should always be lower than the maximum frequency *D203*. The minimum frequency will be reached after start command with selected acceleration ramp up time.

D203: Maximum Frequency (Hz)

This is the maximum output frequency of the AC DRIVE when ***auxiliary drive*** is selected.
In terminal mode, this is the maximum output attained with maximum analog input reference.

D204: Frequency Reference Input

This parameter can be used to select the speed reference input when ***auxiliary drive*** is selected. The speed reference can be independently selected from the given options even if the AC DRIVE is controlled from any of three sources, i.e. Local (Digital Operation Panel), Terminal or Serial. The minimum and maximum limits are decided by *D202* and *D203* respectively in all the options. The options are same as for the main AC DRIVE. Refer *A106* for the detail information. In control version 7.02 and thereafter this parameter show 18 selectable options and In control version 3.17 and thereafter it is show 14 selectable options.

D205: Line Speed Setting (rpm)

The entered value will be displayed as motor speed in *M102* at 50Hz, when ***auxiliary drive*** is selected.

The final speed of the driven load can be displayed by this parameter. The value to be entered can be derived at with following formula:

Parameter Value = 50 x Desired rpm / Set output frequency

Suppose a line speed of 273 is to be displayed when the output is 90Hz.

Parameter Value = 50 X 273 / 90 = 151.667 = 152

Now, at 90Hz the motor speed *M102* will show (152 X 90 / 50) i.e. 274 rpm.

D206: Acceleration Time-1 (Sec)

Acceleration Time-1 is the time taken by AC DRIVE output frequency to ramp up from zero frequency to maximum frequency *D203*, when ***auxiliary drive*** is selected.

Short acceleration time can result in excessive output current and if it exceeds the Acceleration current limit *D403*, the acceleration will cease until the current reduces below the *D403* value. In such case, the actual acceleration time will differ from programmed value. The AC DRIVE may trip in timed over current fault if the condition persists for long time. Increase acceleration time in such cases.

D207: Deceleration Time-1 (Sec)

Deceleration Time-1 is the time taken by AC DRIVE output frequency to ramp down from maximum frequency *D203* to zero frequency.

Short deceleration time can result in excessive output current and if it exceeds the Stall current limit *D401*, the deceleration will cease until the current reduces below the *D401* value. In such case, the actual deceleration time will differ from programmed value. The AC DRIVE may trip in timed over current / dc bus over voltage fault if the condition persist for long time. Increase deceleration time in such cases.

GROUP – 3: TORQUE BOOST & DC BRAKING

D301: Manual Torque Boost setting (%)

This parameter is for the ***auxiliary drive***. When setting manually, set the boost voltage at 0Hz as a percentage in respect to the motor voltage *D101*. When programmed to zero, it will be disabled.

D302: Slip Compensation (Hz)

This parameter is for the ***auxiliary drive***. Set auxiliary motor's rated slip. When setting manually, set the slip frequency for the auxiliary motor rated load in respect to the base frequency. The output frequency changes according to the auxiliary motor rated torque. The output frequency will respond with a time constant of approximately 10msec in respect to the change in the load torque.

D303: DC Brake Start Frequency (Hz)

This is the frequency at which the dc brake will be applied, when the ***auxiliary drive*** is selected. To enable this feature, the stop mode should be ramp down and the dc braking time should not be zero. If dc braking time is zero, this feature will be disabled.

D304: DC brake Current (%)

This parameter decides the dc brake current when the ***auxiliary drive*** is selected.

D305: DC Brake Time (Sec)

This parameter decides the length of time that dc braking is on for the ***auxiliary drive***.

When the stop mode is ramp down and stop command is issued, the output will ramp down with deceleration time. When the AC DRIVE output reaches to dc braking start frequency, the dc voltage is injected to the motor. The amount of voltage and the length of time for which it is applied are decided by the dc braking current *D304* and *D305* respectively.

The dc braking is utilized to stop high inertia load forcefully. During dc braking mechanical energy trapped in rotor due to system inertia will be dissipated as heat in the motor. Hence for safety dc braking is utilized at lower frequency.

GROUP – 4: LIMITING PARAMETERS

D401: Stall Current Limit (%)

This parameter is for the ***auxiliary drive.*** When the AC DRIVE output current crosses the stall current limit, the output ramps down with current limit deceleration time *A209*. This is effective only when the AC DRIVE is operating at set speed. This feature is not active while the AC DRIVE is accelerating or decelerating. When the current decreases below the programmed value, the AC DRIVE again starts accelerating to the set speed with current limit acceleration time *A208*. This feature helps in maintaining relatively constant output torque characteristics.

Set the current limit as a percentage of ***auxiliary motor*** rated current.

D402: Adjustable Over Current Level (%)

This parameter is for the ***auxiliary drive.*** Set the upper current level as a percentage of ***auxiliary motor*** rated current. Whenever the AC DRIVE output current exceeds the set value, the AC DRIVE trips indicating adjustable over current fault. Always set higher side to prevent the unnecessary tripping of the AC DRIVE during normal operation. This gives the user to program the current level below the standard inverse time curve. This may be used in cases where excessive torque shocks can lead to a harmful affect on the machinery.

The default setting of 300% disables this feature and standard inverse time trip remains in effect.

D403: Acceleration Current Limit (%)

This is acceleration current limit for the ***auxiliary drive*** and effective only during normal acceleration. It stops the acceleration, if the motor current exceeds the programmed during acceleration. When the current reduces below the programmed value the AC DRIVE again starts accelerating to the set speed. This feature helps in preventing over current tripping of high inertia load during fast acceleration.

D404: Under Current Level (%)

This parameter is effective only when the ***auxiliary drive*** is selected. This feature trips the AC DRIVE when the current falls below the programmed value for more than 1sec after the speed reaches to set speed. This feature is not active while the AC DRIVE is accelerating or decelerating. Making this 0 will disable this.

Note: *In pump applications, if the flow decreases below a minimum speed there will be cavitations. This feature is useful to turn off the pump in such case.*

MODE – E: RING SPINNING FRAME (RSF) FUNCTION PARAMETERS

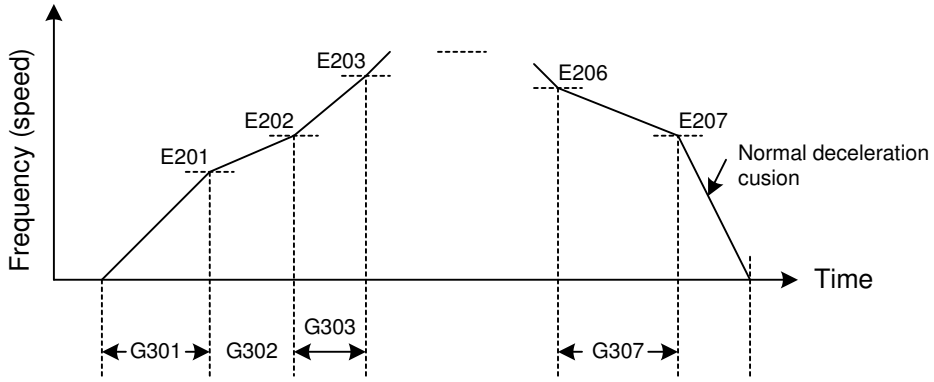
GROUP-1: RSF / PATTERN RUN PARAMETER SELECTION

Ring Spinning Frame function is used to perform spinning pattern operation. In RSF, acceleration / deceleration is performed in a straight line till the set frequency for the next step is reached.

Up to three speed-time pattern (Tables) can be set up to a maximum of 15 steps. Each step is set at the target frequency and time taken to reach that frequency from the previous step.

Select RSF function in *E101* to perform this operation. Now, when RUN command is issued, operation will commence from step-1 of the selected table.

After the pattern has been completed, the inverter will stop according to the selected stop mode in *A304*.



If STOP command is issued during the ring spinning frame operation, inverter will stop according to the selected stop mode in *A304*. When restarting the operation, it will accelerate the output frequency as per the normal acceleration time to the frequency, where inverter was stopped. Now, it will resume the normal RSF operation.

PR/RSF Reset: Assign 'PR/RSF Reset' function to any sequence input terminal. A stop occurs when the PR/RSF Reset is turned ON during RSF operation. Operation is commenced from STEP-1 when restarting the operation.

Doff-End Alarm: By setting the Doff-End alarm time (E105), the Doff-End alarm is output from the point after completion of the final step to the point going back the set time.
The Doff-End alarm remains ON even after the pattern is completed. The Doff-End alarm is cleared by the PR/RSF Reset.
Select the output terminal for the Doff-End alarm with the output selection (C107 to C112).
To restart the operation after the Doff-End alarm is ON, reset the Doff-End alarm using PR/RSF Reset; otherwise it will not allow the operation to start even if the RUN command is reissued.

Hank count display (M213)

The current Hank count displays at monitor M213. The Hank count is obtained using the following formula.

$$H_C = F_{AVG} \times T_{RUN} \times \frac{1}{840} \times Gain$$

F_{AVG} [Hz]: Average frequency
T_{RUN} [sec]: Operation time
840: 1 Hank = 840 yard

F_{AVG} [Hz]: Average frequency
Calculate the average frequency from the given equations considering the stop mode used.

1) Stop Mode (A304) =0: Ramp down to stop

$$\text{Average Frequency} = \frac{S1 + S2 + \ldots + Sn + S_D}{T_{1(sec)} + T_{2(sec)} + \ldots + T_{n(sec)} + T_{D(sec)}}$$

Where,

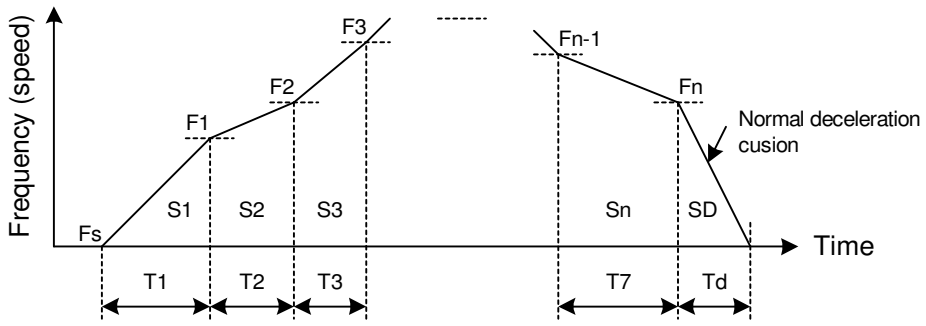
$$S1 = \frac{[F_{s(Hz)} + F_{1(Hz)}] \times T_{1(sec)}}{2}$$

$$Sn = \frac{[F_{n-1(Hz)} + F_{n(Hz)}] \times T_{n(sec)}}{2}$$, n: Step number

$$S_D = \frac{F_{n(Hz)} \times T_{D(sec)}}{2}$$

2) Stop Mode (A304) =1: Coast-to-stop

$$\text{Average Frequency} = \frac{S1 + S2 + \ldots + Sn}{T_{1(sec)} + T_{2(sec)} + \ldots + T_{n(sec)}}$$



It is necessary to set the gain (E106 & E107) in order to display the Hank count correctly. The gain is obtained using the following formula.

$$\text{Gain} = 2p \times R_S \times \frac{2}{\text{Pole}} \times \frac{1}{G_R} \times K_C$$

R_S: Spindle radius [yard]

Pole: Motor pole count

G_R: Gear ratio $= \frac{N_2}{N_1}$ (N_1: Motor gear count, N_2: Spindle gear count)

K_C: Compensation coefficient (Compensate slippage etc.)

The Hank count calculation is continued during operation, however, is reset to zero when the power is turned OFF.

E101: RSF/ Pattern Run Selection

Select any function from Ring Spinning Frame or Pattern Run function.

E102: Table1 Step Selection

Select the number of steps for table-1 for RSF.

E103: **Table2 Step Selection**

Select the number of steps for table-2 for RSF.

E104: **Table3 Step Selection**

Select the number of steps for table-3 for RSF.

E105: Doff End Alarm Time (Sec)

By setting the Doff-End Alarm Time, the Doff-End Alarm is output at the point going back the set time (*E105*) from the moment auto stop occurs after completion of the final step when performing spinning frame operation.

E106: Hank count gain

This is the gain, which is used in hank calculation.

E107: **Hank Gain Multiplier**

Select the multiplier for the hank gain.

E108: Table selection

Select the Table for RSF and Pattern Run function.

GROUP-2: RSF FREQUENCY FOR TABLE-1

E201- E215: Frequency T1 – STP1 ~ STP15 (Hz)

Enter the frequencies for table-1.

GROUP-3: RSF TIME FOR TABLE-1

E301- E315: RSF time T1 – STP1 ~ STP15 (Sec)

Enter the time to reach to the set frequency for each step for table-1.

GROUP-4: RSF FREQUENCY FOR TABLE-2

E401- E415: Frequency T2 – STP1 ~ STP15 (Hz)

Enter the frequencies for table-2.

GROUP-5: RSF TIME FOR TABLE-2

E501- E515: RSF time T2 – STP1 ~ STP15 (Sec)

Enter the time to reach to the set frequency for each step for table-2.

GROUP-6: RSF FREQUENCY FOR TABLE-3

E601- E615: Frequency T3 – STP1 ~ STP15 (Hz)

Enter the frequencies for table-3.

GROUP-7: RSF TIME FOR TABLE-3

E701- E715: RSF time T3 – STP1 ~ STP15 (Sec)

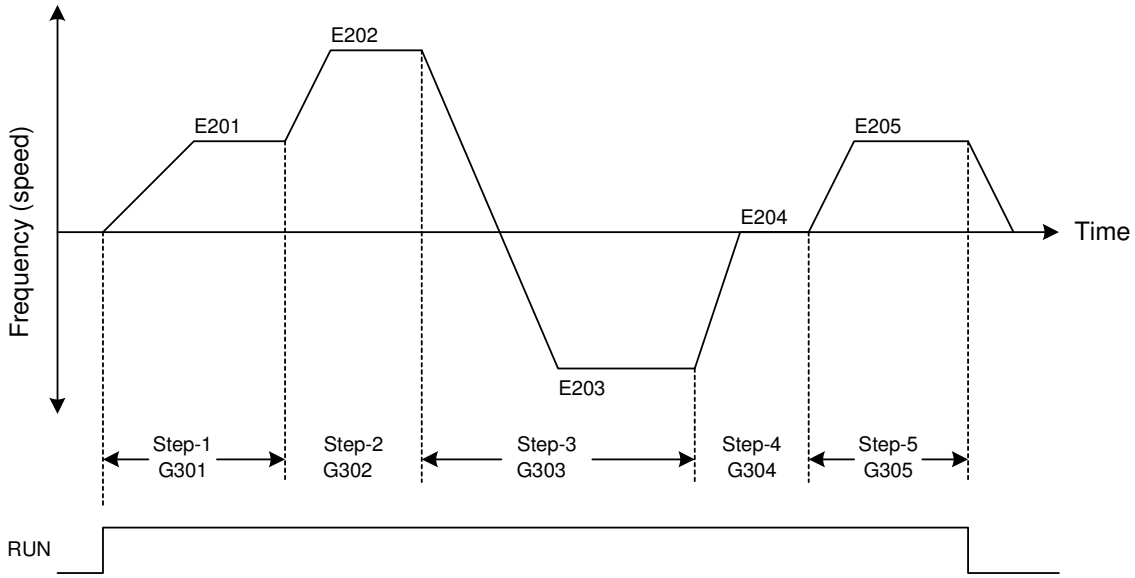
Enter the time to reach to the set frequency for each step for table-3.

MODE – G: PATTERN RUN FUNCTION PARAMETERS

First select the pattern run function in *E101*. With pattern run function, the frequency, run direction and time can be changed automatically.

Maximum of 15-patterns can be set in one table and such two sets of tables are available. Select the table using *E108*. Note that only two tables (table-1 & table-2) are available for the pattern run function.

Set the desired frequency (speed) pattern in E201~E215 for table-1. Use E401~E415 for table-2.
Set the desired time in second to stay at the desired frequency (speed) for each step in G301~G315 for table-1. Use G401~G415 for table-2.
Select the run mode for each step in G101~G115 for table-1. Use G201~G215 for table-2.



Effect of different sequence inputs

RUN: Pattern run starts when RUN command turns ON. The inverter will stop when this is turned OFF. This can be input from Local, Terminal or Serial.

PR Step Skip: Proceeds to the next step at the edge from OFF to ON. By turning this signal ON/OFF with PR Step Hold, the step can be proceeded in synchronization with the peripheral machine regardless of the internal timer.

PR Step Hold: The internal timer operation will stop when this command is ON. This is used to pause the pattern run operation. The inverter will continue to run at the present frequency.

PR/RSF Reset: Assign 'PR/RSF Reset' function to any sequence input terminal. During the Pattern run operation, when this turns ON, the operation will be reset to step-0.

The PR Step Skip and PR Step Hold are valid only when RUN command is ON. PR/RSF Reset is valid all the time.

GROUP-1: MODE SELECTION FOR PATTERN RUN TABLE-1

G101- G115: PR Mode T1 – STP1 ~ STP15

Select the required mode for pattern run function for each step of Table-1
=1: STOP
=2: FORWARD

=3: REVERSE

GROUP-2: MODE SELECTION FOR PATTERN RUN TABLE-2

G201- G215: PR Mode T2 – STP1 ~ STP15

Select the required mode for pattern run function for each step of Table-2
=1: STOP
=2: FORWARD
=3: REVERSE

GROUP-3: PATTERN TIME FOR TABLE-1

G301- G315: PR Time T1 – STP1 ~ STP15

Select the required time for pattern run function for each step of Table-1

GROUP-4: PATTERN TIME FOR TABLE-2

G401- G415: PR Time T2 – STP1 ~ STP15

Select the required time for pattern run function for each step of Table-2

GROUP-5: RETURN STEP FOR TABLE-1

G501- G515: Return Step T1 – STP1 ~ STP15

Select the return step for pattern run function for each step of Table-1

GROUP-6: RETURN STEP FOR TABLE-2

G601- G615: Return Step T2 – STP1 ~ STP15

Select the return step for pattern run function for each step of Table-2

MODE – H: SPECIAL APPLICATION FUNCTION PARAMETERS

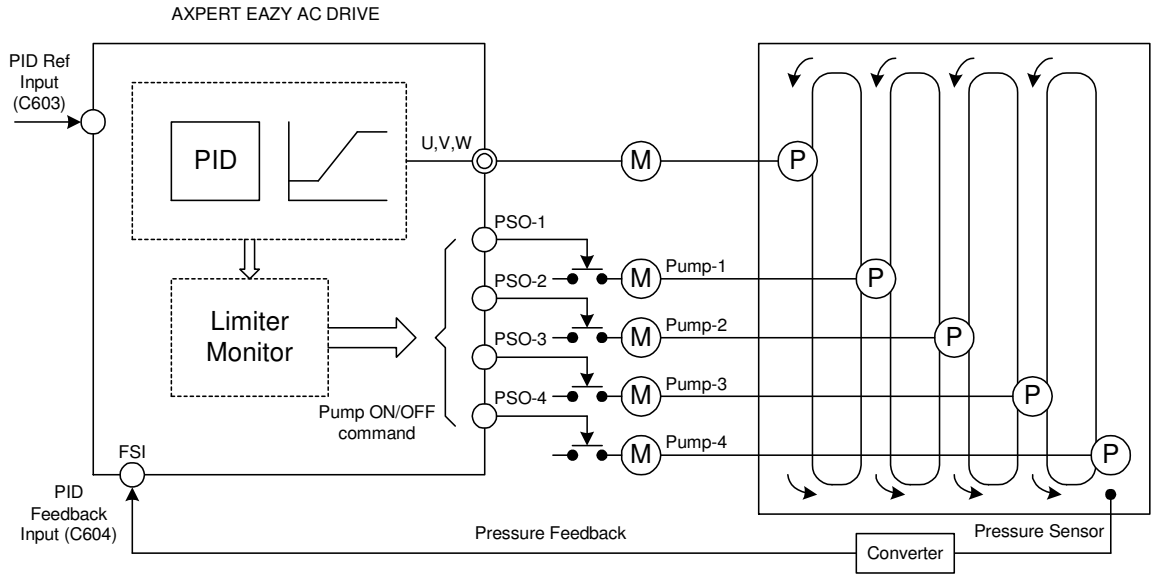
GROUP-1: MULTI-PUMP FUNCTION PARAMETERS

Multi-pump control refers to a function which controls the flow passage pressure at a constant level by running pumps in parallel using one *Axpert-Eazy* AC Drive and it's internal relay output / programmable sequence outputs.

The pressure step of the ON/OFF controlled pumps is interpolated by a pump that is variable-speed controlled by the AC Drive, which has the PID control function. This maintains the pressure's continuation.

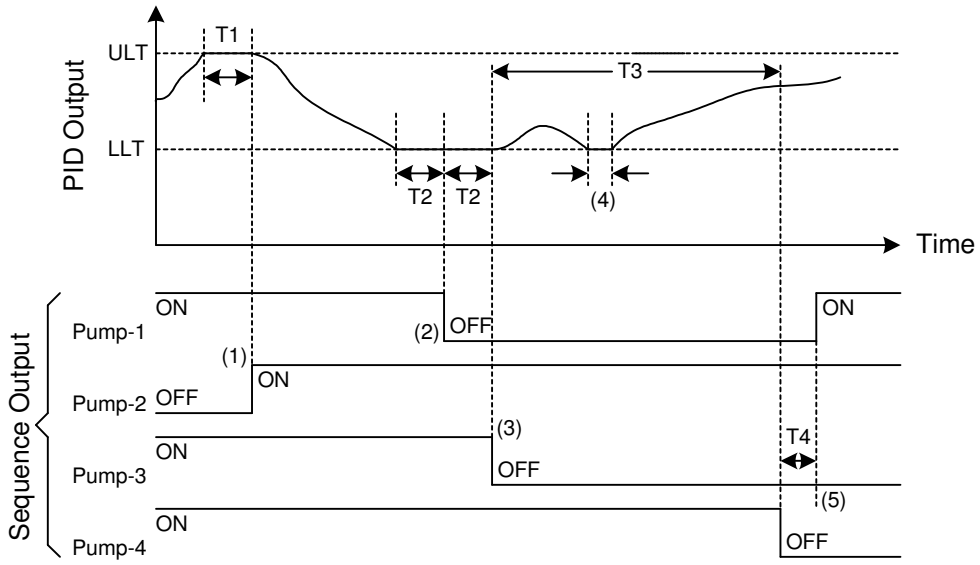
The relay outputs can be used for the pump's ON/OFF control are the programmable relay1, programmable relay2 and programmable sequence output. Assign the pump number to the respective relay / PSO in parameters *C107~C112*.

The system configuration is shown below.



Multi-pump control operation

An example of actual operation for the multi-pump control is shown below.



ON/OFF control pump changeover operation (when operating five pumps)

ULT: PID Deviation Upper Limit (*C608*).
LLT: PID Deviation Lower Limit (*C609*).
$T_{1:}$ Pump start hold time (*H102*)
$T_{2:}$ Pump stop hold time (*H103*)
$T_{3:}$ Pump Continuous ON time limit (*H104*)
$T_{4:}$ Pump Changeover time (*H105*)

The ON/OFF control of multiple pumps is carried out so that the operation time of each pump is equal.

1) When the PID output reaches ULT and T_1 is passed, the auxiliary Pump-2 with the shortest operation time turns ON.
2) When the PID output reaches ULT and T_2 is passed, the auxiliary Pump-1 with the shortest operation time turns OFF.
3) Following (2), when the PID output matches LLT for the time of T_2, the auxiliary Pump-3 with the longest operation time turns OFF.
4) When the time that the PID output and LLT match does not reach T_2, the pump OFF control will not be carried out.

   Pump changeover function using Pump Continuous ON time limit (H104).

5) When the time that the auxiliary pump's ON/OFF control is not carried out reaches T_3, the Pump-4 with the longest operation time within all of the auxiliary pumps turns OFF, and the Pump-1 with the shortest operation time will turn ON after T_4. If *H104* is set to 0, changeover following the continuous operation limit is prohibited.

The variable speed control pump will not change even if the continuous operation limit time is exceeded.

When the inverter is stopped due to the stop command or fault, the pump status will not change and it will remain as it is. To turn off the entire operating pumps, disable the multi-pump operation.

When the inverter's power is turned off, the operation time history for each pump will be lost.

H101: No of Pump Selection

Select the number of pumps to be controlled. Set to zero to disable the multi-pump function.

H102: Pump Start Hold Time (Sec)

If the PID output reaches to upper limit and remains there for more than the set time, the next pump will be switched ON.

H103: Pump Stop Hold Time (Sec)

If the PID output reaches to lower limit and remains there for more than the set time, the next pump will be switched OFF.

H104: Pump Continuous ON Time Limit (Hrs)

If pump's ON/OFF control is not carried out for more than the set time, the pump will change to the longest operating pump to the shortest operating pump.

H105: Pump Changeover Time (Sec)

Set the time for changing from the pump that has been operating longest to the pump operating shortest.

MODE – P: IN-BUILT PLC COMMAND PARAMETERS

Note: *This Mode is available in control version 7.02 and onwards.*

GROUP-1: IN-BUILT PLC COMMAND

P101 ~ P110: PLC Inst 1 ~ PLC Inst 10

Input the In-built PLC Commands as per PLC application.

GROUP-2: IN-BUILT PLC COMMAND

P201 ~ P210: PLC Inst 11 ~ PLC Inst 20

Input the In-built PLC Commands as per PLC application.

GROUP-3: IN-BUILT PLC COMMAND

P301 ~ P310: PLC Inst 21 ~ PLC Inst 30

Input the In-built PLC Commands as per PLC application.

GROUP-4: IN-BUILT PLC COMMAND

P401 ~ P410: PLC Inst 31 ~ PLC Inst 40

Input the In-built PLC Commands as per PLC application.

GROUP-5: IN-BUILT PLC COMMAND

P501 ~ P510: PLC Inst 41 ~ PLC Inst 50

Input the In-built PLC Commands as per PLC application.

GROUP-6: IN-BUILT PLC COMMAND

P601 ~ P610: PLC Inst 51 ~ PLC Inst 60

Input the In-built PLC Commands as per PLC application.

GROUP-7: IN-BUILT PLC COMMAND

P701 ~ P710: PLC Inst 61 ~ PLC Inst 70

Input the In-built PLC Commands as per PLC application.

GROUP-8: IN-BUILT PLC COMMAND

P801 ~ P810: PLC Inst 71 ~ PLC Inst 80

Input the In-built PLC Commands as per PLC application.

GROUP-9: IN-BUILT PLC COMMAND

P901 ~ P910: PLC Inst 81 ~ PLC Inst 90

Input the In-built PLC Commands as per PLC application.

GROUP-A: IN-BUILT PLC COMMAND

PA01 ~ PA10: PLC Inst 91 ~ PLC Inst 100

Input the In-built PLC Commands as per PLC application.

In-built PLC Function Explanation:

In-built PLC Function is one of the important features of this product, by using which, user can make PLC related application without additional hardware. The In-built PLC function has the following features.

Features:

- The In-built PLC can be used to get the same functionality of Programmable Sequence Inputs (PSI).
- It is possible to assign the signals from the In-built PLC to the Programmable Sequences Output (PSO).
- The In-built PLC can be used to get the same functionality as of programmable analog inputs.
- It is possible to assign the signals from the In-built PLC to the analog outputs.
- Bit status of PSI, PSO, Fault codes, Status codes and Control word can be read into the PLC bit memory location.
- Monitor Parameters can be read in to PLC registers (16-bit memory location).
- User can develop program by using PLC Commands based on the required application.
- PLC Commands can be input from the LCD Display. This allows changes to be made easily at the site.
- PLC Commands can be input with the standard serial interface.
- 115 registers (16-bit memory locations) and 100 Flags (1-bit memory location) for PLC operation.
- PLC program's length up to 100 PLC Commands.
- 4 Timer Command can be set from display.

The In-built PLC function-processing chart is shown in fig. 6-1. PLC commands are separate in each parameter and all command (P101 to PA10) execute within 20-millisecond interval.

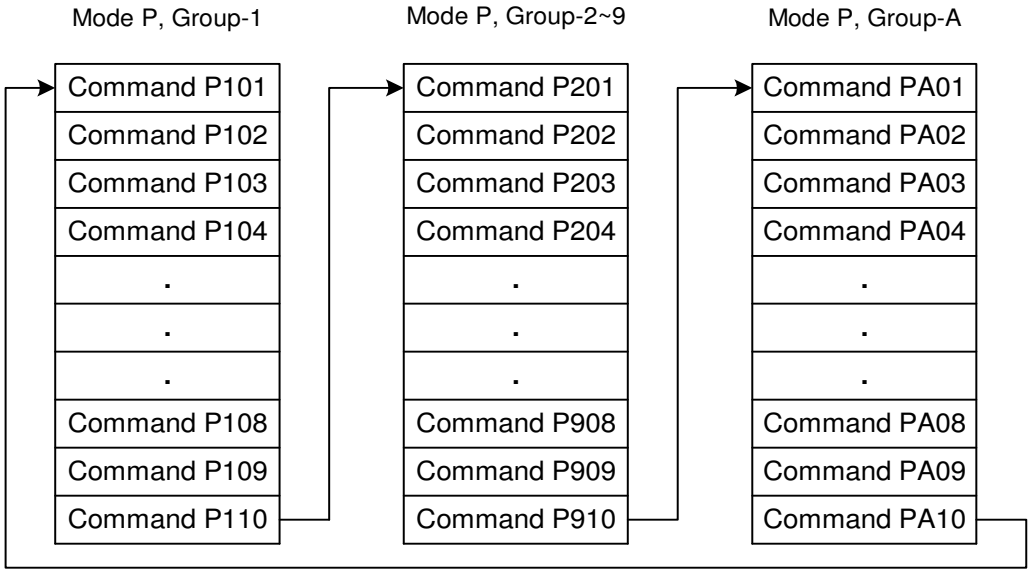


Fig. 6-1 In-built PLC processing Chart

The In-built PLC function starts to read command from the Mode P Group-1 parameter (P101) and executes it one-by-one. END (000) Command indicates end of program and after this command; PLC function again executes from 1st command (P101).

In-built PLC Block

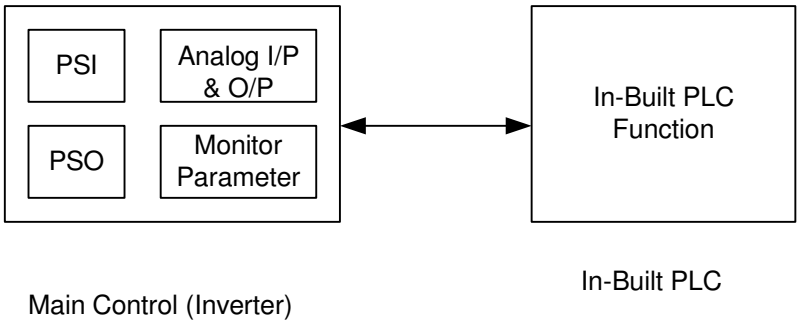


Fig. 6-2 Block Diagram Of In-built PLC function with Main Control

Fig. 6-2 is a block diagram of main control and In-built PLC function. All Digital Input and Output, Analog Input and output are connected with main control.

Now user can program In-built PLC for his application. User can also take output of the drive as PLC Input and output from PLC to the drive as an Input.

In-built PLC Function Related Parameters and Command.
The In-built PLC function related parameters are listed below.

6

1. **In-built PLC *(C312)*:**
   Use this parameter to enable the In-built PLC Function.

2. **In-built PLC Command *(P101 to PA10)*:**
   Input the PLC commands to be executed with the In-built PLC Function in parameters P101 to PA10.

3. **PLC Display Parameter *(M313 to M322)*: In-built PLC → Display**
   For PLC programming, there are 115 numbers of 16-bit register and 100 numbers of 1-bit flag.
   10 values of signed 16-bit register can be displayed in parameter M313 to M322 and these values will be saved in EEPROM at the time of power off. (Related PLC command is DISPLAY_REG (061)) and during power on these parameters value will come in register 76 to 85, 8 different flag bit status can be display in parameter M323. (Related PLC command is DISPLAY_FLG (062)).

4. **Digital Input From Inverter (PSI Status) to In-built PLC:**
   Parameters C101 to C106 and C114 to C115 have 35 selectable options. In these, 28 to 35 are for PLC input options. Now to take PSI status as a PLC input, select one of the PLC input option from these parameters. Use **READ_PSI** (047) command in PLC program for this operation.

5. **Digital Output From In-built PLC to Inverter (PSO Status):**
   Parameters C107 to C113 have 32 Selectable options. In these, 26 to 32 options are for In-built PLC output. Now to take In-built PLC's output as Inverter's PSO output, select one of the PLC option from these parameters. Use **WRITE_PSO** (049) command in PLC program for this operation.

6. **Digital Input From In-built PLC to Inverter (PSI Status):**
   Parameters C101 to C106 and C114 to C115 have 35 selectable options.
   User can activate one of 1 to 27 options of these parameters, without any extern digital signal on PSI by using In-built PLC. Use **WRITE_PSI** (048) command in PLC program for this operation.

7. **Digital Output From Inverter (PSO Status) to In-built PLC:**
   User can read and use status of PSO from inverter for In-built PLC application.
   To read the PSO status in In-built PLC, use **READ_PSO** (046) command in PLC program.

8. **Analog Input From In-built PLC to Inverter:**
   The signals from In-built PLC can be given as Analog Input.
   Parameters A106, A108, A702, D204, C603 & C604 have four PLC A-O/P options.
   User has to select one of these options for this operation. Use **WRITE_AN_O/P** (054) command in PLC program for this operation.

9. **Analog Output From In-built PLC to Inverter:**
   Analog output can be given from In-built PLC.
   Parameters C201 to C204 have four PLC A-O/P options. User has to select one of these options for this operation. Use **WRITE_AN_O/P** (054) command in PLC program.

10. **Analog Input From Inverter to In-built PLC:**
    The Inverter's Analog input signals (FSV, FSI, Iin, Vin) can be read to In-built PLC. These Inputs are stored in Register No. 94 to 97.

11. **Analog Output From Inverter to In-built PLC**
    The Inverter's Analog output signal (C201 to C204's 1 to 7 option) can be read to the In-built PLC. These outputs are stored in Register No. 86 to 93.

12. **In-built PLC PANEL Parameter *(C701 to C712)*: Parameter → In-built PLC**
    Twelve parameters can be input. Related memory location from 101 to 112.

Note: *To get proper output from PLC program, make sure to select correct option in PLC parameters state above. It is advisable to set unused PLC parameters to default conditions.*

Memory Description:

There are 115 numbers of 16-bit register or memory locations, 100 numbers of 1-bit flag and one 32-bit register.
16-bit register description has shown below table.

16-bit Register No.	Name	Access Type	Details	Value
0-75	User Memory	Read/Write	User can Read and Write	-32768 to 32767
76	User Memory	Read/Write	User can Read and Write	M313 – M322 (during power on condition) or -32768 to 32767
77	User Memory	Read/Write	User can Read and Write	
78	User Memory	Read/Write	User can Read and Write	
79	User Memory	Read/Write	User can Read and Write	
80	User Memory	Read/Write	User can Read and Write	
81	User Memory	Read/Write	User can Read and Write	
82	User Memory	Read/Write	User can Read and Write	
83	User Memory	Read/Write	User can Read and Write	
84	User Memory	Read/Write	User can Read and Write	
85	User Memory	Read/Write	User can Read and Write	
86	Output Voltage	Read	Read Output Voltage value	M203
87	Output Current	Read	Read Output Current value	M104
88	Output Power	Read	Read Output Power value	M205
89	Output Frequency	Read	Read Output Frequency value	M101
90	DC Bus Voltage	Read	Read DC Bus Voltage value	M204
91	PID output	Read	Read PID output value	100d = 100%
92	Torque Current	Read	Read Torque Current value	M209
93	Heat sink temperature	Read	Read Heat sink temperature value	M211

16-bit Register No.	Name	Access Type	Details	Value
94	FSV Input	Read	Read input value from FSV	100d = 100%
95	FSI Input	Read	Read input value from FSI	100d = 100%
96	Vin Input	Read	Read input value from Vin	100d = 100%
97	Iin Input	Read	Read input value from Iin	100d = 100%
98-100	Reserved	--	--	--
101	Panel Parameter 1	Read	Read value set with C701	--
102	Panel Parameter 2	Read	Read value set with C702	--
103	Panel Parameter 3	Read	Read value set with C703	--
104	Panel Parameter 4	Read	Read value set with C704	--
105	Panel Parameter 5	Read	Read value set with C705	--
106	Panel Parameter 6	Read	Read value set with C706	--
107	Panel Parameter 7	Read	Read value set with C707	--
108	Panel Parameter 8	Read	Read value set with C708	--
109	Panel Parameter 9	Read	Read value set with C709	--
110	Panel Parameter 10	Read	Read value set with C710	--
111	Panel Parameter 11	Read	Read value set with C711	--
112	Panel Parameter 12	Read	Read value set with C712	--
113-114	Reserved			

All 100 numbers of 1-bit flags are Read/Write, and one 32-bit register is Read/Write.

In-built PLC Command Format:

The PLC commands used with the In-built PLC are 12- digit value shown in below table. These commands can be input from the P101 to PA10 parameter.

0	0	2	0	0	1	0	2	5	0	0	0
OPCODE			**DATA1**			**DATA2**			**DATA3**		

12-digit In-built PLC Command format

Where, OPCODE = Command no.
DATA1 = Data format 1
DATA2 = Data format 2
DATA3 = Data format 3

✓ ***Note:*** *Range of DATA1, DATA2 and DATA3 are different and it depends on command type. See list of PLC Commands for detail. It is necessary to terminate program with END (000) Command.*

Sr. No.	Command Name	Op-Code	DATA1	DATA2	DATA3	Description
1	END	000	000	000	000	End of the Program.
2	REG_LD	001	Register (n)	Value		Load the 16-bit value in Register (n).
3	REG32_LD	002	Register (n)	000	000	Register (n) as a High 16-bit and Register (n+1) as a Low 16-bit are loaded in Register 32 as 32 bits.
4	REG32_ST	003	Register (n)	000	000	Register 32 is store in Register (n) as a High 16-bit and Register (n+1) as a Low 16-bit as 32 bit.
5	REGDEC	005	Register (n)	000	000	Decrement the value of Register (n) by 1.
6	REGINC	006	Register (n)	000	000	Increment the value of Register (n) by 1.
7	COPY_REG	007	Register (n)	Register (m)	000	Copy Register (m) in Register (n).
8	COPY_FLG	008	Flag (n)	Flag (m)	000	Copy Flag (m) in Flag (n).
9	SET_FLG	009	Flag (n)	000	000	Set the Flag (n).
10	CLEAR_FLG	010	Flag (n)	000	000	Clear the Flag (n).
11	ADI	011	Register (n)	Value		Add immediate value. (Register (n) = Register (n) + Immediate Value (0 to 32767)
12	ADD	012	Register (n)	Register (n1)	Register (n2)	Add operation. (Register (n) = Register (n1) + Register (n2)).
13	ADD32	013	Register (n)	000	000	Register (n) as a High 16-bit and Register (n+1) as a Low 16-bit are added to Register 32 as 32 bits. Register 32 = Register 32 + Register (n).
14	SUB	014	Register (n)	Register (n1)	Register (n2)	Subtraction operator (Register (n) = Register (n1) - Register (n2)).
15	SUB32	015	Register (n)	000	000	Register (n) as a High 16-bit and Register (n+1) as a Low 16-bit are subtracted from Register32 as 32 bits. Register 32 = Register 32 - Register (n).
16	MUL32	016	Register (n)	Register (m)	000	Multiplication operator (Register 32 = Register (n) * Register (m)).
17	DIV	017	Register (n)	Register (n1)	Register (n2)	Division operator (Register (n) = Register (n1) / Register (n2)).
18	DIV32	018	Register (n)	000	000	Division operator (Register 32 = Register 32 / Register (n)).
19	AND	019	Flag (n)	Flag (n1)	Flag (n2)	Logical AND operation between Flags (Flag (n) = Flag (n1) & Flag (n2))
20	NAND	020	Flag (n)	Flag (n1)	Flag (n2)	Logical NAND operation between Flags (Flag (n) = ~(Flag (n1) & Flag (n2)))
21	NOR	021	Flag (n)	Flag (n1)	Flag (n2)	Logical NOR operation between Flags (Flag (n) = ~ (Flag (n1) | Flag (n2)).
22	XOR	022	Flag (n)	Flag (n1)	Flag (n2)	Logical XOR operation between Flags (Flag (n) = Flag (n1) ^ Flag (n2)).
23	XNOR	023	Flag (n)	Flag (n1)	Flag (n2)	Logical XNOR operation between Flags (Flag (n) = ~ (Flag (n1) ^ Flag (n2))).
24	OR	024	Flag (n)	Flag (n1)	Flag (n2)	Logical OR operation between Flags (Flag (n) = Flag (n1) | Flag (n2)).
25	NOT_FLG	025	Flag (n)	Flag (m)	000	Invert the specified Flag (Flag (n) = ~Flag (m)).
26	NOT_REG	026	Register (n)	Register (m)	000	Invert the specified register (Register (n) = ~Register (m))
27	WAND	027	Register (n)	Register (n1)	Register (n2)	Logical Word (16-bit) AND operation between registers (Register (n) = Register (n1) & Register (n2))
28	WOR	028	Register (n)	Register (n1)	Register (n2)	Logical Word (16-bit) OR operation between registers (Register (n) = Register (n1) | Register (n-2))
29	WXOR	029	Register (n)	Register (n1)	Register (n2)	Logical Word (16-bit) XOR operation between registers (Register (n) = Register (n1) ^ Register (n2))

Sr. No.	Command Name	Op-Code	DATA1	DATA2	DATA3	Description
30	NEG	030	Register (n)	000	000	Negative. Register (n) = - Register (n)
31	ABS	031	Register (n)	000	000	Absolute the value of Register (n). Register (n) = ABS (Register (n))
32	CMP_GT	035	Flag (n)	Register (n)	Register (m)	If Register (n) is greater than Register (m) then given Flag (n) is set.
33	CMP_LT	036	Flag (n)	Register (n)	Register (m)	If Register (n) is less than Register (m) then given Flag (n) is set.
34	CMP_GE	037	Flag (n)	Register (n)	Register (m)	If Register (n) is greater than or equal to Register (m) then given Flag (n) is set.
35	CMP_LE	038	Flag (n)	Register (n)	Register (m)	If Register (n) is less than or equal to Register (m) then given Flag (n) is set.
36	CMP_EQ	039	Flag (n)	Register (n)	Register (m)	If Register (n) is equal to Register (m) then given Flag (n) is set.
37	CMP_NE	040	Flag (n)	Register (n)	Register (m)	If Register (n) is not equal to Register (m) then given Flag (n) is set.
38	IF	041	Flag (n)	000	000	If given Flag (n) is set then condition is true and execute IF routine until ELSE or END_IF.
39	ELSE	042	000	000	000	If IF condition is false then ELSE loop will execute until END_IF.
40	END_IF	043	000	000	000	Specify the end of IF and ELSE Loop.
41	JUMP	044	X (1-100)	000	000	JUMP to X command no.
42	READ_PSO	046	Flag (n)	1-7	000	Read the status of selected PSO (1-7) in selected Flag (n).
43	READ_PSI	047	Flag (n)	1-8	000	Read the status of selected PSI (1-8) in selected Flag (n).
44	WRITE_PSI	048	1-25	Flag (n)	000	Assign value of Flag (n) in PSI function (1-25).
45	WRITE_PSO	049	1-7	Flag (n)	000	Assign value of Flag (n) in PSO (1-7).
46	READ_MON_PARA	050	Register (n)	0-115	000	Read the value of monitor parameter (0-115) in Register (n).
47	READ_STA_BIT	051	Flag (n)	1-2	0-15	Read the value of status bit (0-15) of status register (1-2) in Flag (n).
48	READ_FLT_BIT	052	Flag (n)	1-2	0-15	Read the value of fault bit (0-15) of fault register (1-2) in Flag (n).
49	READ_CWORD_BIT	053	Flag (n)	1-2	0-15	Read the value of control bit (0-15) of control word (1-2) in Flag (n).
50	WRITE_AN_O/P	054	1-4	Register (n)	000	Assign the value of Register (n) to selected Analog O/P (1-4). i.e 100D = 10V.
51	TIMER1	057	000	000	000	Input = Flag no 92 Output = Flag no 93 Count = C701 * C702 ms Count in multiple of 1ms. Maximum Timer 298 Hour.
52	TIMER2	058	000	000	000	Input = Flag no 94 Output = Flag no 95 Count = C703 * C704 ms Count in multiple of 1ms. Maximum Timer 298 Hour.
53	TIMER3	059	000	000	000	Input = Flag no 96 Output = Flag no 97 Count = C705 * C706 ms Count in multiple of 1ms. Maximum Timer 298 Hour.
54	TIMER4	060	000	000	000	Input = Flag no 98 Output = Flag no 99 Count = C707 * C708 ms Count in multiple of 1ms. Maximum Timer 298 Hour.
55	DISPLAY_REG	061	X1 (1-10)	Register (n)	000	It will display the value of Register (n) to selected display number. It will be stored in EEPROM on Power off mode.

Sr. No.	Command Name	Op-Code	DATA1	DATA2	DATA3	Description
56	DISPLAY_FLG	062	X1 (0-7)	Flag (n)	000	It will display value of selected Flag (n) on X1 bit location.
57	LPF1	063	Register (n)	Register (m)	Tc (0-100)	Inputs = Register (m) and Tc (in mS) LPF Output = Register (n)
58	LPF2	064	Register (n)	Register (m)	Tc (0-100)	
59	LPF3	065	Register (n)	Register (m)	Tc (0-100)	
60	LPF4	066	Register (n)	Register (m)	Tc (0-100)	
61	JMPC	067	X (1-100)	Flag (n)	000	If Flag (n) = 1, then JUMP to X Command no.
62	JMPNC	068	X (1-100)	Flag (n)	000	If Flag (n)! = 1, then JUMP to X Command no.

- Range of n, n1, n2 and m are 0 to 114 for register and 0 to 99 for flag.
- Register 0 to 85 have Read and Write access. Register 86 to 114 are Read Only.
- Flag status is single bit locations, which is 0 to 99.
- Memory Locations for Registers and Flag status are different.
- X1 indicate Display parameter (M313 to M323)
- X indicates Command No.

In-built PLC Command Detail Description:

1. END (OPCODE → 000)
This command indicates End of PLC program. Any command after this command (END) will not be executed.
Input Command
000000000000

2. REG_LD (OPCODE → 001)
This command is used to Load 16-bit signed value into selected register.

Example,
REG_LD Rn 32000
Where,
Rn = Register Number (0 to 85)
Input Command
001001032000
001 → indicates Command OPCODE
001 → indicates Register Number 1
032000 → indicate 16-bit value (32000).

3. REG32_LD (OPCODE → 002)
This command is used to load 32-bit value into 32-bit Register.

Example,
REG32_LD Rn
Where,
Rn = Register Number (0 to 113)
32-bit register = value of Register (n) as a high byte and the value of Register (n+1) as a low byte.
Input Command
002001000000
002 → Indicate Command OPCODE
001 → Indicates Register Number 1
000 → Not used
000 → Not used

4. REG32_ST (OPCODE → 003)
This command is used to store 32-bit value into Register.

Example,
REG32_ ST Rn
Where,
Rn = Register Number (0 to 84)
High byte of 32-bit value will be store into selected Rn and Low byte of 32-bit value will be stored into selected R (n+1).
Input Command
003001000000
003 → Indicate Command OPCODE
001 → Indicates Register Number 1
000 → Not used
000 → Not used

5. REGDEC (OPCODE → 005)
This command is used to Decrement the value of selected register by one.

Example,
REGDEC Rn
Where,
Rn = Register Number (0 to 85)

6. REGINC (OPCODE → 006)
This command is used to increment the value of selected register by one.

Example,
REGINC Rn
Where,
Rn = Register Number (0 to 85)

7. COPY_REG (OPCODE → 007)
This command is used to copy the content of one register (Rm) to another register (Rn).

Example,
COPY_REG Rn Rm
Where,
Rn = Register Number (0 to 85)
Rm = Register Number (0 to 114)

8. COPY_FLG (OPCODE → 008)
This command is used to copy the bit status of one Flag (Fm) to another Flag (Fn).

Example,
COPY_ FLG Fn Fm
Where,
Fn and Fm = Flag Number (0 to 99)

9. SET_FLG (OPCODE → 009)
This command is used to set the bit status of selected Flag (Fn).

Example,
SET_FLG Fn
Where,
Fn = Flag Number (0 to 99)

10. CLEAR_FLG (OPCODE → 010)
This command is used to clear the bit status of selected Flag (Fn).

Example,
CLEAR_FLG_FLG Fn
Where,
Fn = Flag Number (0 to 99)

11. ADI (OPCODE → 011)
This command is used for summation of immediate signed 16-bit value and Register.

Example,
ADI Rn 32000
Where,
Rn = Register Number (0 to 85)
Result will be stored in Rn. (Rn = Rn + 32000).

12. ADD (OPCODE → 012)
This command is used for 16-bit summation operation of two registers.

Example,
ADD Rn Rn1 Rn2
Where,
Rn = Register Number (0 to 85)
Rn1, Rn2 = Register Number (0 to 114)
Result will be stored in Rn. (Rn = Rn1 + Rn2)

13. ADD32 (OPCODE → 013)
This command is used for 32-bit summation.

Example,
ADD32 Rn
Where,
Rn = Register Number (0 to 113)
Register Rn as high byte and Rn+1 as low byte and it will be added to 32-bit register. Result will be stored into 32-bit Register.

14. SUB (OPCODE → 014)
This command is used for 16-bit subtraction of two registers.

Example,
SUB Rn Rn1 Rn2
Where,
Rn = Register Number (0 to 85)
Rn1, Rn2 = Register Number (0 to 114)
Result will be stored in Rn. (Rn = Rn1 – Rn2)

15. SUB32 (OPCODE → 015)
This command is used for 32-bit Subtraction.

Example,
SUB32 Rn
Where,
Rn = Register Number (0 to 113)
32bit Register = 32bit Register - Rn
Register Rn as high byte and Rn+1 as low byte and it will be subtracted from 32-bit register. Result will be stored into 32-bit Register.

16. MUL32 (OPCODE → 016)
This command is used for multiplication operation of two registers.

Example,
MUL32 Rn Rm
Where,
Rn and Rm = Register Number (0 to 114)
32bit Register = Rn * Rm.
Result will be stored in 32-bit Register.
Result should not be exceeding more then 32-bit value.

17. DIV (OPCODE → 017)
This command is used for division of two registers.

Example,
DIV Rn Rn1 Rn2
Where,
Rn = Register Number (0 to 85)
Rn1, Rn2 = Register Number (0 to 114)
Result will be stored in Rn. (Rn = Rn1 / Rn2).

18. DIV32 (OPCODE → 018)
This command is used for division of 32-bit value.

Example,
DIV32 Rn
Where,
Rn = Register Number (0 to 114)
Result will be stored in 32-bit Register. (32bit Register = 32bit Register / Rn.)

19. AND (OPCODE → 019)
This command is used for logical AND operation between two bits of Flags.

Example,
AND Fn Fn1 Fn2
Where,
Fn, Fn1 and Fn2 = Flag Number (0 to 99)
Result will be stored in Fn. (Fn = Fn1 & Fn2)

20. NAND (OPCODE → 020)
This command is used for logical NAND operation between two bits of Flags.

Example,
NAND Fn Fn1 Fn2
Where,
Fn, Fn1 and Fn2 = Flag Number (0 to 99)
Result will be stored in Fn. (Fn = ~(Fn1 & Fn2))

21. NOR (OPCODE → 021)
This command is used for logical NOR operation between two bit Flags.

Example,
NOR Fn Fn1 Fn2
Where,
Fn, Fn1 and Fn2 = Flag Number (0 to 99)
Result will be stored in Fn. (Fn = ~(Fn1 | Fn2))

22. XOR (OPCODE → 022)
This command is used for logical XOR operation between two bit Flags.

Example,
XOR Fn Fn1 Fn2
Where,
Fn, Fn1 and Fn2 = Flag Number (0 to 99)
Result will be stored in Fn. (Fn = Fn1 ^ Fn2)

23. XNOR (OPCODE → 023)
This command is used for logical XNOR operation between two bit Flags.

Example,
XNOR Fn Fn1 Fn2
Where,
Fn, Fn1 and Fn2 = Flag Number (0 to 99)
Result will be stored in Fn. (Fn = ~(Fn1 ^ Fn2))

24. OR (OPCODE → 024)
This command is used for logical OR operation between two bit Flags.

Example,
OR Fn Fn1 Fn2
Where,
Fn, Fn1 and Fn2 = Flag Number (0 to 99)
Result will be stored in Fn. (Fn = Fn1 | Fn2)

25. NOT_FLG (OPCODE → 025)
This command is used for logical NOT operation of selected bit Flag.

Example,
NOT_FLG Fn Fm
Where,

Fn and Fm = Flag Number (0 to 99)
Result will be stored in Fn. (Fn = ~Fm)

26. NOT_REG (OPCODE → 026)
This command is used for logical NOT operation of selected Register.

Example,
NOT_REG Rn Rm
Where,
Rn = Register Number (0 to 85)
Rm = Register Number (0 to 114)
Result will be stored in Rn. (Rn = ~Rm)

27. WAND (OPCODE → 027)
This command is used for 16-bit logical AND operation of selected two Registers.

Example,
WAND Rn Rn1 Rn2
Where,
Rn = Register Number (0 to 85)
Rn1, Rn2 = Register Number (0 to 114)
Result will be stored in Rn (Rn = Rn1 & Rn2).

28. WOR (OPCODE → 028)
This command is used for 16-bit logical OR operation of selected two Registers.

Example,
WOR Rn Rn1 Rn2
Where,
Rn = Register Number (0 to 85)
Rn1, Rn2 = Register Number (0 to 114)
Result will be stored in Rn. (Rn = Rn1 | Rn2)

29. WXOR (OPCODE → 029)
This command is used for 16-bit logical XOR operation of selected two Registers.

Example,
WXOR Rn Rn1 Rn2
Where,
Rn = Register Number (0 to 85)
Rn1, Rn2 = Register Number (0 to 114)
Result will be stored in Rn. (Rn = Rn1 ^ Rn2)

30. NEG (OPCODE → 030)
This command is used for negative operation of selected Register.

Example,
NEG Rn
Where,
Rn = Register Number (0 to 85)
Result will be stored in Rn. (Rn = -Rn)

31. ABS (OPCODE → 031)
This command is used for absolute operation of selected Register.

Example,
ABS Rn
Where,
Rn = Register Number (0 to 85)
Result will be stored in Rn. (Rn = ABS (Rn))

Note: *OPCODE no. 032 to 034 Reserved.*

32. CMP_GT (OPCODE → 035)
This command is used for compare application.

Example,
CMP_GT Fn Rn Rm
Where,
Rn and Rm = Register Number (0 to 114)
Fn = Flag number (0 to 99)
It will compare Rn and Rm, and if Rn is greater than Rm then it will set Fn (bit status) to 1.

33. CMP_LT (OPCODE → 036)
This command is used for compare application.

Example,
CMP_LT Fn Rn Rm
Where,
Rn and Rm = Register Number (0 to 114)
Fn = Flag number (0 to 99)
It will compare Rn and Rm, and if Rn is less than Rm then it will set Fn (bit status) to 1.

34. CMP_GE (OPCODE → 037)
This command is used for compare application.

Example,
CMP_GE Fn Rn Rm
Where,
Rn and Rm = Register Number (0 to 114)
Fn = Flag number (0 to 99)
It will compare Rn and Rm, and if Rn is greater than and equal to Rm then it will set Fn (bit status) to 1.

35. CMP_LE (OPCODE → 038)
This command is used for compare application.

Example,
CMP_LE Fn Rn Rm
Where,
Rn and Rm = Register Number (0 to 114)
Fn = Flag number (0 to 99)
It will compare Rn and Rm, and if Rn is less than and equal to Rm then it will set Fn (bit status) to 1.

36. CMP_EQ (OPCODE → 039)
This command is used for compare application.

Example,
CMP_EQ Fn Rn Rm
Where,
Rn and Rm = Register Number (0 to 114)
Fn = Flag number (0 to 99)
It will compare Rn and Rm, and if Rn is equal to Rm then it will set Fn (bit status) to 1.

37. CMP_NE (OPCODE → 040)
This command is used for compare application.

Example,
CMP_NE Fn Rn Rm
Where,

Rn and Rm = Register Number (0 to 114)
Fn = Flag number (0 to 99)
It will compare Rn and Rm, and if Rn is not equal to Rm then it will set Fn (bit status) to 1.

38. IF (OPCODE → 041)
This command is used for condition application.

Example,
IF Fn
Where,
Fn = Flag number (0 to 99)
If Fn is 1 then it will go to IF loop otherwise it will execute the PLC code written after **ELSE** command.

39. ELSE (OPCODE → 042)
This command is used for condition application.

Example,
ELSE
If **IF** command condition is false then it will go to the ELSE loop. Otherwise it will execute the PLC code written after **END_IF** command.

40. END_IF (OPCODE → 043)
This command indicates end of IF and ELSE condition loop.
NOTE: *END_IF command must be used after IF, ELSE command.*

Example,

```
IF Fn                    OR      IF Fn
.....                            .....
END_IF                           ELSE
                                     .....
                                 END_IF
```

Note: *Nested IF….ELSE…..END_IF statement is not supported.*

41. JUMP (OPCODE → 044)
This command is used for branch application.

Example,
JUMP Xn
Where,
Xn = Command Number (1 to 100)
It will JUMP to selected Xn Command number and start executing from there.

Note: *OPCODE no. 045 Reserved.*

42. READ_PSO (OPCODE → 046)
This command is used to read PSO status in selected Flag Number.

Example,
READ_PSO Fn PSOm
Where,
Fn = Flag number (0 to 99)
PSOm = PSO number (1 to 7)

43. READ_PSI (OPCODE → 047)
This command is used to read PSI status from inverter to In-built PLC.
For this, user must have to select below PLC option in Inverter parameters C101 to C106 and C114 to C115.

Example,
READ_ PSI Fn PSIm
Where,
Fn = Flag number (0 to 99)
PSIm = PSI number (1 to 8)

	FLAG NO	PSI SELECTABLE OPTIONS (C101 to C106 and C114 to C115)
READ PSI	BIT STATUS OF FLAG	28: PLC I/P 1
		29: PLC I/P 2
		30: PLC I/P 3
		31: PLC I/P 4
		32: PLC I/P 5
		33: PLC I/P 6
		34: PLC I/P 7
		35: PLC I/P 8

44. WRITE_PSI (OPCODE → 048)
This command is use to Activate PSI terminal function from In-built PLC.
PSI terminal have 27 selectable options.

Example,
WRITE_PSI PSIFunction (m) Fn
Where,
Fn = Flag number (0 to 99)
PSI Function (m) = PSI Selectable option (1 to 27)
It will load bit result of selected flag into PSI selected option.
Note: *User should take care; below selectable options should be use either in In-built PLC or in PSI parameters (C101 to C106 and C114, C115) at one time.*

	Select one of the Options		Flag No
WRITE_PSI	1:Not Used	14:Terminal	Bit Status of Flag
	2:Jog Select	15:Ref Select 0	
	3:Ramp Select	16:Ref Select 1	
	4:Preset i/p-0	17:PR Step Skip	
	5:Preset i/p-1	18:PR Step Hold	
	6:Preset i/p-2	19:PR/RSF Reset	
	7:Freq Increase	20:PID Bypass	
	8:Freq Decrease	21:PID Disable	
	9:Aux Drive	22:E-Stop (NC)	
	10:E-Stop (N0)	23:Ext Flt (NC)	
	11:Fault Reset	24:RUN	
	12:Ext Flt (NO)	25:STOP	
	13:Reverse	26:Drive Ebl NC	
		27:Drive Ebl NO	

45. WRITE_PSO (OPCODE → 049)

This command is used to write PSO status from In-built PLC to Inverter.
For this, user must have to select below PLC option in inverter parameters C107 to C113.

Example,
WRITE_PSO PSO (m) Fn
Where,
PSO (m) = PSO no. (1 to 7)
Fn = Flag no. (0 to 99)

	PSI SELECTABLE OPTIONS (C107 to C113)	FLAG NO
WRITE_PSO	26:PLC O/P 1	BIT STATUS OF FLAG
	27:PLC O/P 2	
	28:PLC O/P 3	
	29:PLC O/P 4	
	30:PLC O/P 5	
	31:PLC O/P 6	
	32:PLC O/P 7	

46. READ_MON_PARA (OPCODE → 050)
This command is used to read the monitor parameter value into the selected Register Number.

Example,
READ_MON_PARA Rn ModId
Where,
Rn = Register Number (0 to 85)
ModId = Modbus Id of Monitor Parameter (0 to 115)
Reference: Serial guide Manual
Example,
to read parameter M104, Output Current 's Modbus id is 40004. So
ModId = 40004 – 40001 = 3

47. READ_STA_BIT (OPCODE → 051)
This command is used to read bit status of Status Register in selected Flag Number.

Example,
READ_STA_BIT Fn StsRegNo BitNo
Where,
Fn = Flag number (0 to 99)
StsRegNo**.** = Status Register Number (1 to 2)
BitNo. = Bit Number (0 to 15)

48. READ_FLT_BIT (OPCODE → 052)
This command is used to read bit status of Fault Code Register in selected Flag Number.

Example,
READ_FLT_BIT Fn FltRegNo BitNo
Where,
Fn = Flag number (0 to 99)
FltRegNo**.** = Fault code Register Number (1 to 2)
BitNo. = Bit Number from (0 to 15)

49. READ_CWORD_BIT (OPCODE → 053)
This command is used to read bit status of Control Word Register in selected Flag Number.

Example,
READ_CWORD_BIT Fn CwordRegNo BitNo
Where,
Fn = Flag number (0 to 99)
CwordRegNo = Control Word Register Number (1 to 2)
BitNo. = Bit Number from (0 to 15)

50. WRITE_AN_O/P (OPCODE → 054)
This command is used to set Analog Output or Analog Input by the use of selected Register value. Register value should be in the range of 0 to 100d. Where 0d will give 0Volt and 100d will give 10Volt.

Example,
WRITE_AN_O/P PLCAOPn Rn
Where,
PLCAOPn = PLC analog output number (PLCAOP1 to PLCAOP4).
Rn = Register Number (0 to 114).

FOR ANALOG OPUTPUT:
Analog output will come according to selection of **C201** to **C204**.
To get PLC analog output at **VO1** terminal, one of the selectable options from **8:PLC A-O/P 1** to **11:PLC A-O/P 4** should be set at **C201**.

FOR ANALOG INTPUT:
Analog Input can be given to Parameters A106, A108, A702, D204, and C603 & C604 from In-built PLC by setting one of four PLC A-O/P options and using this command.

51. TIMER1 (OPCODE → 057)
This command is used to set fix timing event for required application.

Example,
TIMER1
1 count = 1 ms
Final count = C701 * C702 (Parameter)
Flag Number **92 is Input** Flag and Flag Number **93 is Output** Flag for Timer1.
TIMER1 is down counter. It will start after Flag number 92 is set to 1.it will only work if 92 Flag number is set otherwise it will stop counting.
When TIMER1 will become zero, Flag number 93 will be set. Maximum Timer is 298 hour.

52. TIMER2 (OPCODE → 058)
Final count = C703 * C704 (Parameter)
Flag Number **94 is Input Flag** and Flag Number **95 is Output** Flag for Timer2.
Same as TIMER1.

53. TIMER3 (OPCODE → 059)
Final count = C705 * C706 (Parameter)
Flag Number **96 is Input** Flag and Flag Number **97 is Output** Flag for Timer3.
Same as TIMER1.

54. TIMER4 (OPCODE → 060)
Final count = C707 * C708 (Parameter)
Flag Number **98 is Input** Flag and Flag Number **99 is Output** Flag for Timer4.
Same as TIMER1.

55. DISPLAY_REG (OPCODE → 061)
This command is used to display the Register value on Display Panel and save it to EEPROM on Power OFF mode.

Example,
DISPLAY_REG X1 Rn
Where,

X1 is the Display Number of Display Panel, which are 1 to 10. (M313 to M322)
Rn = Register Number (0 to 114)
User can also display the value of Read only Register.

56. DISPLAY_FLG (OPCODE → 062)
This command is used to display the bit status of Flag Number on Display Panel and save it to EEPROM on Power OFF mode. Total 8 number of flag bit status can be shown.

Example,
DISPLAY_FLG Bitloc Fn
Where,
Bitloc = bit location (0 to 7) of shown parameter on Display Panel (M232)
Fn = Flag Number (0 to 99)

57. LPF1 (OPCODE → 063)
This command is used for the low pass filter.

Example,
LPF1 Rn Rm Tc
Where,
Rn = Register number (0 to 85)
Rm = Register number (0 to 114)
Tc = Time constant. (0 to 100)
Result will be stored in Rn.

58. LPF2 (OPCODE → 064)
59. LPF3 (OPCODE → 065)
60. LPF4 (OPCODE → 066)
Same as LPF1.

61. JMPC (OPCODE → 067)
This command is used for conditional Branch application.

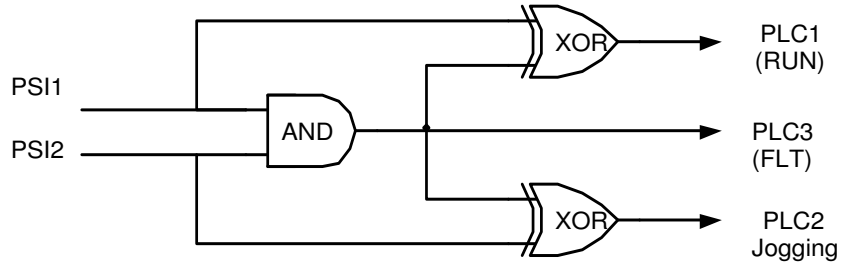
Example,
JMPC Xn Fn
Where,
Xn = Command Number (0 to 100)
Fn = Flag Number (0 to 99)
If Fn (flag no) in equal to 1, then It will JUMP to selected Xn Command number and start executing from there.

62. JMPNC (OPCODE → 068)
This command is used for conditional Branch application.

Example,
JMPC Xn Fn
Where,
Xn = Command Number (0 to 100)
Fn = Flag Number (0 to 99)
If Fn (flag no) in not equal to 1, then It will JUMP to selected Xn Command number and start executing from there.

In-built PLC Applications

Example 1
This example is used to control three signals by the use of two PSI.
As shown here if PSI1 will become Active and PSI2 is Inactive then RUN status will become Active.
If PSI2 will become Active and PSI1 is Inactive then JOGGING status will become Active.
If both are Active at the same time then Fault will generate.



Program Code:

To write PLC program from display panel, programmer should keep following points in mind.

1. There is a PLC Program mode in Display Panel, which is **Mode-P.**
   In Mode-P there are total **10 groups** from **P101 to PA01**. So user can write up to 100 commands.
2. User has to start PLC programming from **P101,** and then continue to the **P110.**
   After reaching there if user still want to enter commands then he should go to another group **P201** and start writing commands from there, likewise he can write 100 commands.
3. Now before start PLC programming, user should have knowledge of the PLC commands and op-code.
4. If you will come to the **P101** you will find 12-digit value. Here first 3-digit from left is for **OPCODE** of commands you want to use. Second, third and fourth 3-digit depends upon which Command you are using.

Example,

047001001000
047 is opcode of READ_PSI command.
001 is for memory location of Bit number (Flag no.1), which is user memory.
001 is for PSI1 status.
000 is not used.

Input from Display Panel into P101 to PA01

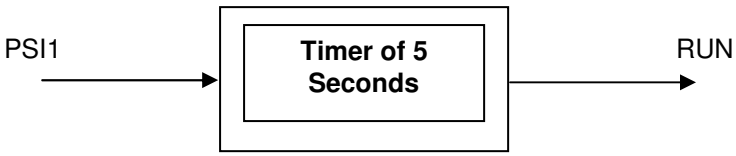
Parameter No.	PLC Command	Description
P101	047001001000	Copy the PSI1 status into Flag no. 1.
P102	047002002000	Copy the PSI2 status into Flag no. 2.
P103	008003001000	Copy the bit status Flag no. 1 into Flag no. 3.
P104	008004002000	Copy the bit status Flag no. 2 into Flag no. 4.
P105	019001001002	AND operation between two Flags and result will be stored in flag no. 1.
P106	022003003001	XOR operation between two Flags and result will be stored in flag no. 3.
P107	022004004001	XOR operation between two Flags and result will be stored in flag no. 4.
P108	048012001000	Write the Flag no.1's result into the PSI's selectable option no. 12 which is **Ext Flt (NO)**.
P109	048024003000	Write the Flag no. 3's result into the PSI's selectable option no. 24, which is **RUN**.
P110	048002004000	Write the Flag no. 4's result into the PSI's selectable option no. 2, which is **Jog Select**.
P201	000000000000	End of Program.

6

Note:
User can use 0 to 99 single bit locations for general application.
User has to set following parameter.

1. *Enable PLC function from C312.*
2. *Select option 28 in C101.*
3. *Select option 29 in C102.*
4. *Select option 1 in C114.*

Example 2
This application can be used when RUN is required after certain delay.
In this example when Digital input will be applied to PSI1, RUN will be activated after 5 seconds of delay. To keep RUN status active PSI1 should be applied permanently otherwise RUN will become Inactive.



Program Code:
Input from Display Panel into P101 to PA01.

Parameter No.	PLC Command	Description
P101	047001001000	Copy the PSI1 status into Flag no. 1.
P102	008092001000	Copy the bit status of Flag no. 1 into Flag no. 92.
P103	057000000000	Here 5000 count (C701*C702) has been loaded to the TIMER1.
P104	048024093000	Write the bit status of Flag to the PSI's selectable option number 24, which is RUN.
P105	000000000000	End of Program.

Note: *User should consider fix format for TIMER COMMAND. There are 4 Timer commands. All are used as same format.*

Example,

057000000000
057 is opcode for TIMER1 command.
Parameter C701 = 1
Parameter C702 = 5000
So, 1 * 5000 = 5000 count will be loaded in to timer1 (1 count = 1ms)
User has to set following parameter.

1. Enable PLC function from C312.
2 Select 28 no. Selectable option in C101.
3. C701 = 1 and C702 = 5000.
4. Select option 1 (Not Used) in C114.

Example 3
This example demonstrates how to use memory location (Register 0 to 114) for 16-bit value.

Program Code:
Input from Display Panel into P101 to PA01.

Parameter No.	PLC Command	Description
P101	001002000050	Load 16-bit Immediate value (50) into Register no.2
P102	054001002000	Content of Register no. 2 is copied to PLC A-O/P 1. Here 0d = 0 volt and 100d = 10 volt
P103	001003000010	Load 16-bit Immediate value into Register no.3
P104	035001003002	It will compare two Registers. If Register 3 is greater then 2, than flag no. 1 will be SET (1) otherwise it will reset (0).
P105	049002001000	Write the bit status of Flag no.1 into PLCPSO2.
P106	000000000000	End of Program.

Note: *User should consider fix format for* ***REG_LD*** *COMMAND.*
Example,

001002000050
001 is opcode for REG_LD command.
002 Register number 2(Memory location for 16-bit value.)
000050 indicate one signed 16-bit value. (Maximum value is 32767.)
User has to set following parameter.

1. Enable PLC function from C312.
2. Select 8 no. Selectable option in C201. Output will come on Vo-1 terminal.
3. Selects 27 no. Selectable option in C107. Output will come on PSO1 terminal.

Note: *User can use 0 to 85 16-bit memory locations for general application. These are read and write memory locations. From 86 to 114 memory location contains analog values of internal parameters, which are given in In-built PLC Function's manual. These memory locations are read only.0 to 114 16-bit memory locations and 0 to 99 bit memory locations both are different.*

Example 4
This example is given to just demonstrate how to use 16-bit memory locations (Register 0 to 114) and 32-bit memory location.

Program Code:
Input from Display Panel into P101 to PA01.

Parameter No.	PLC Command	Description
P101	001001001000	Copy 16-bit Immediate value (1000) into Register no.1
P102	001002032000	Copy 16-bit Immediate value (32000) into Register no.2
P103	001003001000	Copy 16-bit Immediate value (1000) into Register no.3
P104	001004030000	Copy 16-bit Immediate value (30000) into Register no.4
P105	002003000000	It will take Register no 3 as high 16-bit and Register no 4 as low 16-bit and save it to 32-bit memory location as 32-bit value.
P106	013001000000	It will take Register no 1 as high 16-bit and Register no 2 as low 16-bit and form 32-bit value, which will be added to the content of 32-bit memory location. Result will be saved to 32-bit memory location.
P107	003005000000	It will take high 16-bit of the content of 32-bit memory location and store it to Register no 5 and low 16 -bit to the Register no 6.
P108	061001005000	It will display the content of Register no 5 on Display Panel. (M313)
P109	061002006000	It will display the content of Register no 6 on Display Panel. (M314)
P110	000000000000	End of Program.

User has to set following parameter.

1. Enable PLC functions from C312.

Note: *There is only one 32-bit memory location is given.*
During 32-bit load and store commands user should use only 0 to 84 16-bit memory locations.

Example 5
This application can be used to monitor feedback of analog voltage input 0-10Vdc by the use of PLC on Display Panel.

Program Code:
Input from Display Panel into P101 to PA01.

Parameter No.	PLC Command	Description
P101	016094108000	Multiplication between Register 94 and 108 and result will be stored in 32-bit memory location.
P102	001001000100	Copy 16-bit Immediate value (100) into Register no.1
P103	018001000000	Division between 32-bit memory location and register 1 and result will be stored in 32-bit memory location
P104	003010000000	The value of 32-bit memory location is stored in Register 10 as high and register 11 as low 16-bit value.
P105	028012010011	Word OR logic between Register 10 and 11 and result will be store in Register 12.
P106	061001012000	Display Register 12 in PLC Display Number 1.
P107	000000000000	End of Program.

User has to set following parameter.

1. Enable PLC function from C312.
2. Register 94 contains FSV input, which is read only memory location.
3. Register 108 contains value of Panel Para8 **(C708)** which is used for multiplication factor, and that should be change as per input quantity range.

Note: *There is only one 32-bit memory location is given.*

During 32-bit load and store commands user should use only 0 to 84 16-bit memory locations.

Example 6.
This application can be used to monitor feedback on FSV and convert it to other quantity by the use of PLC and display on Display Panel to monitor up to certain limit and give trip (External Fault).

Program Code:
Input from Display Panel into P101 to PA01.

Parameter No.	PLC Command	Description
P101	016094108000	Multiplication between Register 94 and 108 and result will be stored in 32-bit memory location.
P102	001001000100	Copy 16-bit Immediate value (100) into Register no.1
P103	018001000000	Division between 32-bit memory location and register 1 and result will be stored in 32-bit memory location
P104	003010000000	The value of 32-bit memory location is stored in Register 10 as high and register 11 as low 16-bit value.
P105	028012010011	Word OR logic between Register 10 and 11 and result will be store in Register 12.
P106	061001012000	Display Register 12 in PLC Display Number 1.
P107	035001012102	If Register 12 is greater than Register 102 then Flag number 1 will be set
P108	048012001000	Status of flag 1 will be written to **12:EXT_FLT** option of PSI's selectable options.
P109	000000000000	End of Program.

User has to set following parameter.

1. Enable PLC function from C312.
2. Register 94 contains FSV input, which is read only memory location.
3. Register 108 contains value of Panel Para8 **(C708)** which is used for multiplication factor, and that should be change as per input quantity range.

Note: *There is only one 32-bit memory location is given.*
During 32-bit load and store commands user should use only 0 to 84 16-bit memory locations.

Example 7

This application can be used to monitor feedback on FSV and convert it to other quantity. And to take sample after every 1-second, 1-minute and 1-hour and display them on separate Display Parameters.
Samples of 1-second and 1-minute will be reset but samples of 1-hour will be continuously Increased to measure total input quantity.

Program Code:
Input from Display Panel into P101 to PA01

Parameter No.	PLC Command	Description
P101	016094108000	To find feedback.
P102	001001000100	
P103	018001000000	
P104	003010000000	
P105	028012010011	
P106	061001012000	
P107	057000000000	Set Timer1 of 1 second
P108	009092000000	Start Timer1
P109	041093000000	**1 second routine**-
P110	010093000000	Find summation of 60 samples and store it into register 5
P201	012005005012	
P202	006020000000	
P203	043000000000	
P204	001021000060	
P205	037010020021	To check if 60 samples are taken
P206	041010000000	**1 minute routine** –
P207	010010000000	If 60 samples are taken then find the average value of feedback register 5 and store it to register 6.
P208	017006005021	And again take other 60 samples from register 6 and add it to register 7.
P209	012007007006	
P210	001005000000	
P301	001020000000	
P302	006030000000	
P303	043000000000	
P304	001060000060	
P305	037030030060	To check if 60 samples are taken
P306	041030000000	**1 hour routine**-
P307	010030000000	If 60 samples are taken then add value of register 7 to register 9. And display register 9 on Display Para3 which indicate total input quantity.
P308	001030000000	
P309	012009009007	
P310	061003009000	
P401	043000000000	
P402	001051010000	
P403	037055009051	Whenever register 9 will be greater 10000 it will reset to 0 and register 56 will be increased by one, which indicates that 10000 of total quantity input. (If it is increased to 2 that will indicate 20000 of total quantity input)
P404	041055000000	
P405	006056000000	
P406	001009000000	
P407	010055000000	

Parameter No.	PLC Command	Description
P408	043000000000	
P409	047025001000	If PSI is given then it will reset all Registers and total quantity input.
P410	041025000000	
P501	001005000000	
P502	001020000000	
P503	001007000000	
P504	001006000000	
P505	001009000000	
P506	001056000000	
P507	00103000000	
P508	061003009000	
P509	061005056000	
P510	043000000000	
P601	061002007000	To Display values of registers.
P602	061004009000	
P603	061005056000	
P604	061006020000	
P605	061007030000	
P606	000000000000	End of program

User has to set following parameter.

1. Enable PLC function from C312.
2. Register 94 contains FSV input, which is read only memory location.
3. Register 108 contains value of Panel Para8 **(C708)** which is used for multiplication factor, and that should be change as per input quantity range.
4. Select 28 no. Selectable option in C101.
5. C701 = 10 and C702 = 100. (10*100 = 1000 count for Timer1)

Note: *There is only one 32-bit memory location is given.*
During 32-bit load and store commands user should use only 0 to 84 16-bit memory locations.

Example 8
This application is to demonstrate Low Pass filter command.

Program Code:
Input from Display Panel into P101 to PA01

Parameter No.	PLC Command	Description
P101	063001094030	Input is Register 94(FSV) and Time constant is 030. LPF output will be in Register 1.
P102	061001001000	Output is displayed on Display Para1.
P103	000000000000	End of program

User has to set following parameter.

1. Enable PLC function from C312.
2. Register 94 contains FSV input, which is read only memory location.

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CHAPTER-7: ELECTRONICS CIRCUIT BOARDS

Axpert-Eazy Series AC AC DRIVE has following electronics circuit boards.

7-1 Main Control Board

The Control Board PCA-2014A/PCA-2004A is a multipurpose board and specifically designed to meet the high-end performance of the power electronics products like AC DRIVE, Front-end converter, PWM DC Drive etc…

It uses **32-bit High-Performance Digital Signal Processor TMS320F2811**. The control board generates the necessary pwm control signals for AC DRIVE operation. It accepts various inputs from different circuits, gate drive board and Digital Operation Panel (LCD Keypad Module) to generate the necessary control and gate signals.

The TMS320F2811 (U1) is the heart of this board. It handles the user interfaces and core algorithm and generates IGBT gate signals. The PCA-2014A/ PCA-2004A is connected to PCA-2012 Display Card with RS-485 link. PCA-2012 display various parameters of the drive.

7-2 Display Board

The unit is equipped with Digital Operation Panel (LCD Keypad Module) for the user interface. All parameters of drives can be accessed from Digital Operation Panel. The Digital Operation Panel consists of Display Board PCA-2012 and 8-keys. The display board uses 20x4 Liquid Crystal Display (LCD).

It has LPC2368 ARM micro-controller. When interfaced with main control board PCA-2014A/ PCA-2004A, this becomes master and the main control boards works as slave. The master and slave communication is based on RS-485 (Modbus-RTU Protocol).

7-3 Power Supply Unit

For 400V series
PCA-92A is used as Power Supply Unit. This unit provides the power to all boards in the drive. The input to the power supply board is 350~800Vdc. The different outputs of the power supply board are +15V/2.2A, -15V/0.5A, +5V/1A and +24V/0.5A.

For 500V and 600V series
PCA-125A is used as Power Supply Unit. This unit provides the power to all boards in the drive. The input to the power supply board is 400~1200Vdc. The different outputs of the power supply board are +15V/2.2A, -15V/0.5A, +5V/1A and +24V/0.5A.

7-4 IGBT Gate Driver Boards

PCA-1024 or PCA-1018A or PCA1029 are used for IGBT gate driving circuit. This is used to drive the IGBT switches. Depending on the AC DRIVE size, different driver boards are used. It requires +15V power supply. Main control board PCA-2014A/ PCA-2004A provides the input gate pulse via wire interface or fiber optic cable. In case of fault, it transmits the same to the main control board.

7-5 MOV, RC Snubber, SC & Bleeder Board

This is snubber board for the input diode. PCA-91 is a combination of R and C connected across the dc bus. This board also includes Soft charge resister and MOV network to protect the unit against the surge / voltage transients coming in the power lines. This is used up to AMT-055-4 rating.

7-6 Bleeder Board

For 400V series
PCA-83/85/86 Bleeder board equalizes the dc bus voltage across the series capacitors.
For 500V and 600V series

PCA-123/124/127 Bleeder board equalizes the dc bus voltage across the series capacitors.

7-7 RC Snubber Board

PCA-82 is snubber board for the input diode. It is a combination of R and C connected across the dc bus.

7-8 MOV Board

PCA-77 is connected at the input of the unit. It protects the unit against the surge / voltage transients coming in the power lines.

7-9 Interface Board for Multiple Inverters Unit

The Interface Board PCA-2013A is used when multiple inverter units are connected in parallel. It uses 32-bit High-Performance Digital Signal Processor TMS320F2811.

This board has a facility up to five no's of inverter units are connected in parallel. This board has an eight channel of temperature measurement and five channel of three phase current measurement.

7-10 Thyristor Firing Board (PCA-152)

PCA-152 is used to control thyristors in half controlled rectifier. This board also has a MOV network to protects the unit against the surge / voltage transients.

CHAPTER-8: MAINTENANCE, INSPECTION AND PART REPLACEMENT

DANGER

- Always wait at least 20 minutes after turning the input power OFF before starting inspection.
  Wait at least 20 minutes after turning the input power OFF before starting work. Make sure that the displays on the operation panel have gone out before removing the front cover.
  Remove the front cover, and confirm that the "DC BUS CHARGE LED" on bleeder board has gone out. Also check that the voltage between terminals L+1 or L+2 and L– is 15V or less before starting the inspections.
  Failure to observe this could lead to electric shocks.
- Maintenance, inspections and part replacement must be done by a designated person.
  (Remove all metal accessories such as watches, bracelets, etc., before starting the work.)
  (Always use an insulation measure tool.)
  Failure to observe this could lead to electric shocks and injuries.
- Always turn the power OFF before inspecting the motor or machine. A potential is applied on the motor terminal even when the motor is stopped.
  Failure to do so could lead to electric shocks and injuries.
- Do not use parts other than those designated for the replacement parts.
  Contact your AC DRIVE dealer for replacement parts.
  Failure to observe this could lead to fires.
- Never modify the product.
  Failure to observe this could lead to electric shocks or injuries or product failure.

CAUTION

- ✓ Vacuum the AC DRIVE with a vacuum cleaner to clean it. Do not use water or organic solvents.
  Failure to observe this could lead to fires or damage.
- ✓ Do not megger the unit.
  Failure to observe this could lead to damage to semiconductor devices.

8-1 Inspection items

The inspections must be carried out periodically according to the working environment and frequency of use. If there are any abnormalities, the cause must be inspected immediately and countermeasures taken.

8-1-1 Daily inspections

Inspection item	Inspection details and work
Temperature/humidity	Confirm that the ambient temperature is 0℃ (32℉) to 50℃ (122℉) for 400 Volt series Drive and 0℃ (32℉) to 40℃ (104℉) for 500/600 Volt series Drive, and that the humidity is 95% or less with no dew condensation.
Oil mist and dust	Confirm that there is no oil mist or dust in the AC DRIVE.
Abnormal noise and vibration	Confirm that there is no abnormal noise or vibration from the installation site or AC DRIVE.
Input power source	Confirm that the input voltage and frequency are within the specifications range.
Cooling fan	Confirm that the cooling fan rotates normally and that no lint, etc. is stuck on it.
Indicator	Confirm that all lamps on the operation panel light properly.

8-1-2 Periodic Inspections

Inspection item	Inspection details and work
Appearance	Check the state of dirt and dust on the vent or heatsink, and clean if necessary.
Interior	Check the state of dirt and dust on the PCB and inside the equipment, and clean if necessary.
Terminal block	Tighten the terminal block screws if loose.
Cooling fan	Replace the fan every three years.
Electrolytic capacitor	Confirm that there is no liquid leaking or sheath discoloration.
Insulation resistance inspection	Do not perform a megger test on the AC DRIVE. When doing a megger test on the external circuit, disconnect all wires connected to the AC DRIVE.
Encoder	Confirm that there is no looseness or play in the bearings or couplings. The bearings are durable parts. Life of bearing is approx. 10,000 hours at 6000rpm, and approx. 30,000 hours at 3000rpm.They must be replaced periodically.

8-1-3 Inspection of spares

The inspection shown in above table must also be performed for spare AC DRIVEs that are left connected but are not used in normal operation. The operation of the AC DRIVE must be checked every six months by turning the power on.

8-2 Measuring devices

As the voltage and current on the input and output sides include high harmonics, the measured value will differ according to the measuring device. When measuring with a device for commercial frequencies, measure with the following circuits and noted measuring devices.

Input voltage: Moving iron type voltmeter or Rectifying voltmeter

Output voltage: Moving iron type voltmeter

Input / output power: Electrodynamometer type wattmeter

CHAPTER-9: OPTIONS

Besides the standard features available in the ***Axpert-Eazy*** **series AC DRIVE**, which satisfies most of the industrial applications, *AMTECH* offers its users a spectrum of optional products designed to match their requirement.

The list of optional products offered by *AMTECH* herewith is all developed, field tested and commissioned at various locations in India. A brief description of the option is given. Contact *AMTECH* with relevant data to design one for you.

9-1 Green Power Technology

Non-linear loads like AC DRIVE, UPS, Converters etc. draw power from mains in a way, which introduce harmonic currents into the mains. They behave like harmonic source, which feeds harmonic to all the equipments, connected with the power source. **IEEE STD 519: 1992; *IEEE Recommended Practices and Requirements for Harmonic Control in Electric Power System*** states that it is the responsibility of the consumer to curb this mains 'Pollution' at the source point itself within acceptable limits.

AMTECH offers *Input Harmonic Converter* as a solution for this problem. As per the requirement and acceptable limits of induced harmonics such converters can be tailor made for you. Contact *AMTECH* for details on *Input Harmonic Converter.*

9-2 Output Sinus Filter

Output of any AC DRIVE is Sine PWM (Pulse Width Modulation) modulated at high frequency carrier wave. When this kind of waveform encounters motor load, it tends to create very high dV/dt stress for the stator winding. After a long time the stator insulation gets weakened up and ultimately the stator flashover takes place. The problem is particularly severe in places where the location of motor and AC DRIVE is at large distance. This happens because of the impedance mismatch between cable and the motor surge impedance. This can reach as high as 1.9 times the DC bus voltage.

Output Sinus Filter helps to outcome this problem. The output after sinus filter becomes sinusoidal and the Motor gets relieved from excessive dV/dt stress. Motor can be placed far away from AC DRIVE. The motor loss due to harmonic heating also reduces considerably.

Output Sinus Filter also helps in controlling the EMI and RFI generated by the power cable and motor. That means an added advantage for equipments operating with small voltages and high frequencies. Contact *AMTECH* for details on *Output Sinus Filter*.

9-3 Input/ Output Filter

Input filter is installed before the converter stage of the any AC DRIVE to smoothen the current drawn from mains power supply. This also improves the wave shape at the input, as the peak value of drawn current is restricted and the mains transformer do not goes towards saturation.

Output filter with around 3% impedance helps in changing the characteristic impedance of the motor. Now the AC DRIVE sees the output filter as the reflecting impedance and the filtering choke bears the dV/dt spikes. Thus the dV/dt transient do not hampers the motor thereby increasing its insulation life and reduced heating. Alternatively *RC Filters* and *LC Filters* and other passive component combinations are also designed to suit a particular requirement. For sizing and best filter selection for your system, contact *AMTECH*.

9-4 Metering

At times there may be need of monitoring the internal AC DRIVE data. Optional analog or digital metering of AC DRIVE operating data like various voltages, currents, rpm etc can be provided in the panel. For the AC DRIVE data, which can be monitored, and the extra hardware, contact *AMTECH* for details.

9-5 Enclosure

Some applications may demand enclosures, which suit the environment where the unit is to be installed. Protection against water or ingress or against some harmful ambient gas can be provided within the scope of the manufacturer. The enclosure can be modified for required degree of protection like IP54/ 55. Occasionally the shape and size of the enclosure can also be discussed for incorporating the unit in some other predefined structure. Contact *AMTECH* for details on *Enclosure options.*

9-6 Battery Backup AC DRIVE

For critical applications where the equipment can't bare the stoppage due to interruptions in the power supply or its complete failure, *AMTECH* offers battery backup AC DRIVEs. This is also applicable at locations where the input power provided for AC DRIVE is DC. Contact *AMTECH* for details on *Battery Backup AC DRIVE.*

9-7 Remote Operator Box

Remote box for operation from near the actual driven motor site can be provided for the user with optional controls and displays. We remind you here that our standard keypad control box can be taken up to 1000 feet without any problem. Contact *AMTECH* for details on *Remote Operator Box.*

9-8 EMI Filter

AC DRIVE output carries high frequency carrier wave generates electromagnetic radiations. *AMTECH* offers EMI filters to minimize the affect of AC DRIVE generated EMI noise on other equipments, which are microprocessor based, and are placed very near to such EMI sources.

9-9 Dynamic Braking Unit

Dynamic breaking up 100% of the unit rating can be provided for high inertia loads, which require fast deceleration. The mechanical inertial rotating energy is converted into electrical energy and dissipated at dynamic breaking resistors. Contact *AMTECH* for details on *Dynamic Braking.*

9-10 AC DRIVE Bypass

A bypass with Direct-On-Line or Star-Delta bypass start can be provided for motor at critical places where the process cannot bear any eventuality arising out of AC DRIVE failure. Contact *AMTECH* for the scheme of bypass and other details on *AC DRIVE bypass option*.

CHAPTER-10: ENCODER SPECIFICATIONS

10-1 Applicable encoder specifications

An encoder is used as a standard Line Driver type for the speed detection. The applicable encoder specifications are as below.

Item	Specifications
Supply voltage	5VDC ± 0.25V
Output method	Line driver type
Output signal voltage	VH (signal high-level voltage): 2.5V or more, VL (signal low level Voltage): 0.5V or less at input terminal of PCA-2014A/ PCA-2004A. (Differential voltage of A+, B+ in respect to A-, B-)
Supply current **Note 1**	Max. 200mA (including signal supply current)
Output signal	90° ± 30° phase difference signal (A phase, B phase) **Note 2**
Pulse output frequency	Maximum output pulse frequency is 300kHz when the motor rotates at the maximum speed.

10.2 Wiring example

An example of the connection with standard line driver type +5V operated encoder is shown below.

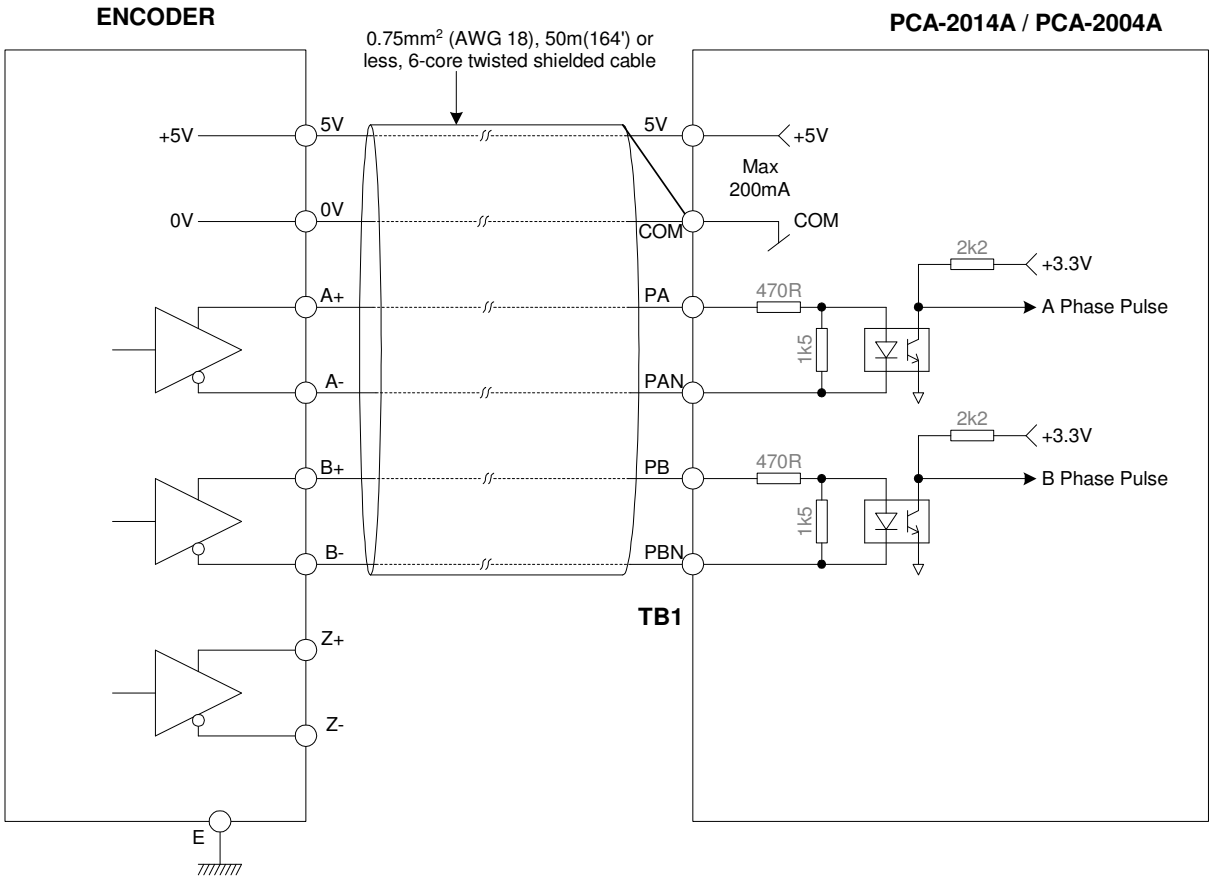


Fig. 10-1

Note 1: In case the current requirement of encoder exceeds 200mA, connect separate power source to the encoder and connect 0V of power source to COM of PCA-2014A/ PCA-2004A. Do not connect 5V of the power source to +5V of PCA-2014A/ PCA-2004A.

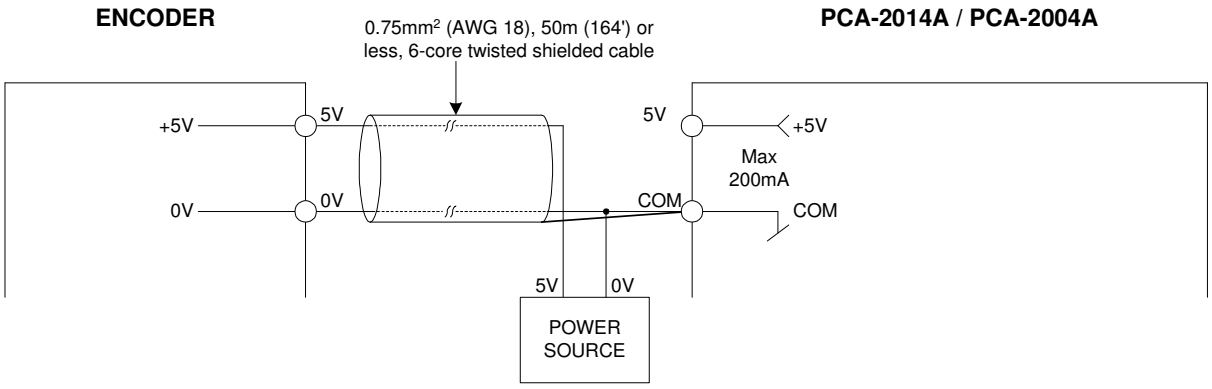


Fig. 10-2

Note 2: A phase pulse and B phase pulse of input to the PCA-2014A/ PCA-2004A are given as bellow when a motor rotates forward. A, B phase pulses mean differential voltages of A+, B+ against A-, B-.

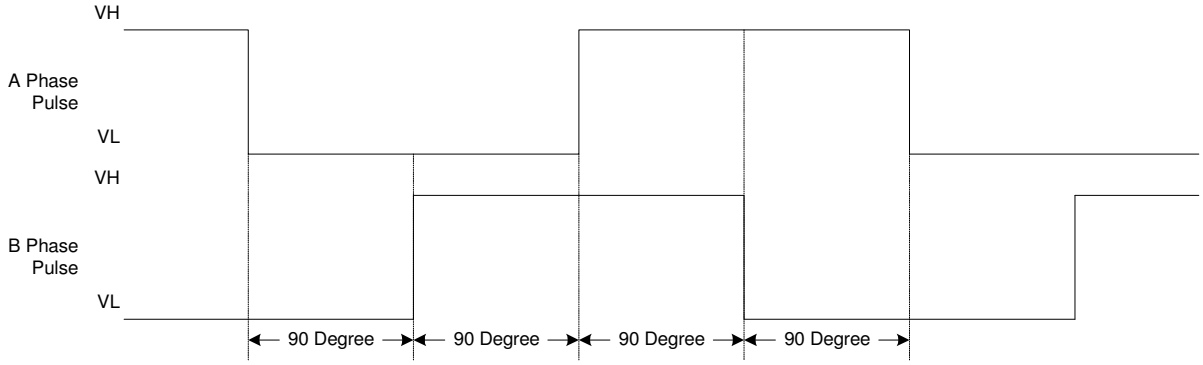


Fig. 10-3

CHAPTER-11: SERIAL COMMUNICATION SET-UP

The *Axpert-Eazy* Drive is equipped with a serial communication function using RS485 as a standard. It acts as a Modbus slave in the network. The unit can be controlled with a host computer (master) using this function.

11-1 Connection method

This network is configured of one host computer (master) and 1 to 247 max *Axpert-Eazy* units (slaves). TB1 on main control board is used for the connection.

Refer to Chapter-2 Installation and Wiring for wiring the control signal and for the wiring methods.

The total length of the connected cable must be within 300mt (1000ft).

By using a commercially available RS485-RS232C converter or USB converter unit, the inverter can be connected to a host computer equipped with a serial port or USB, such as a commercially available personal computer.

The details of the TB1 terminal section are shown below.

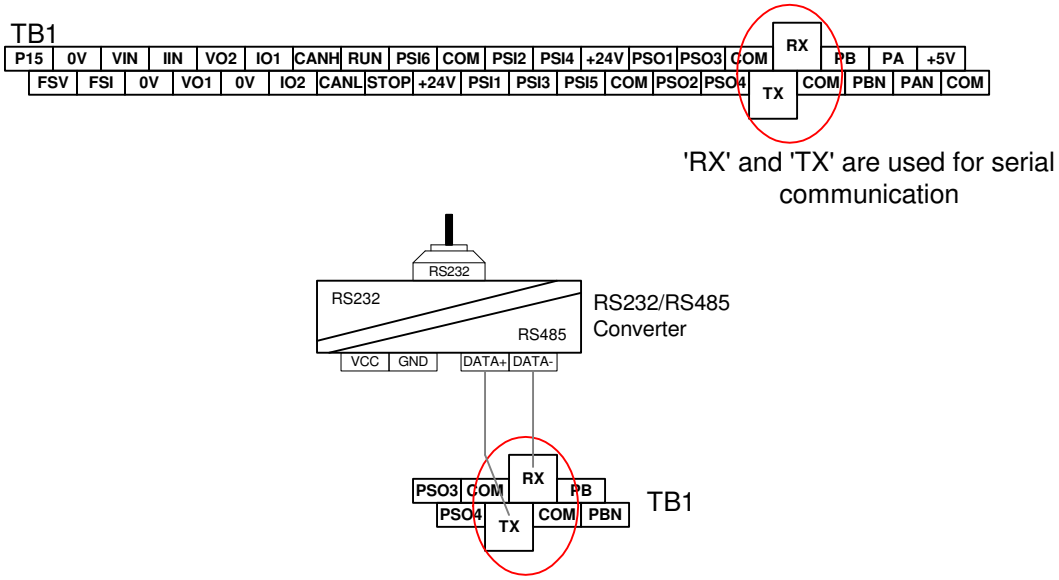


Fig. 11-1

11-2 Connecting the host computer and Axpert-Eazy (1-to-1)

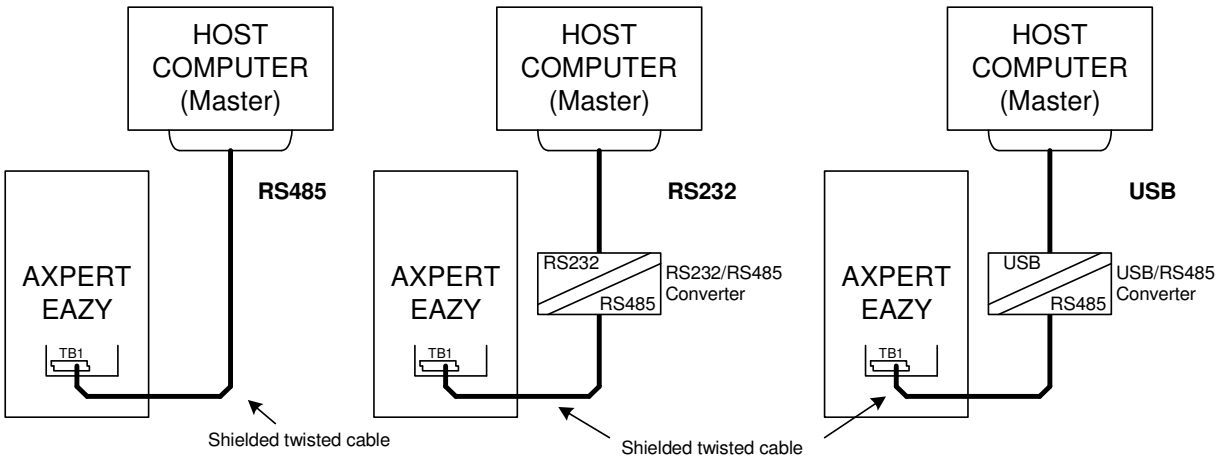
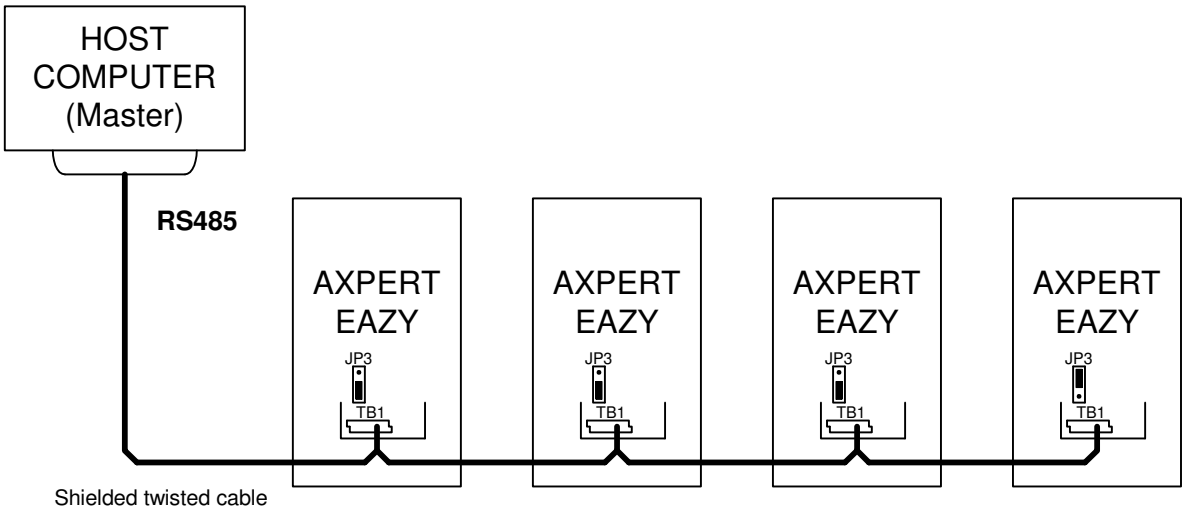


Fig. 11-2

CAUTION

- ✓ Separates the communication cable from the main circuit cable and other power cables.
- ✓ A shielded twisted pair cable should be used for connecting TB1 and the host computer. Connect the shielded twisted pair cable's shield to the COM terminal of TB1.
- ✓ When connecting the TB1 and shielded twisted pair cable, do not solder the wires, which are exposed after the sheath is peeled off.
- ✓ If the communication is distorted and not carried out properly because of noise, etc., connect a ferrite core, etc., to the cable, and increase the noise resistance.
- ✓ When connecting several *Axpert-Eazy* units, connect two wires to each TB1 terminal, and couple the *Axpert-Eazy* units. An example of the connection is shown below.

11-3 Connecting the host computer and Axpert-Eazy (1-to-many units)



The details of the TB1 terminal section are shown below.

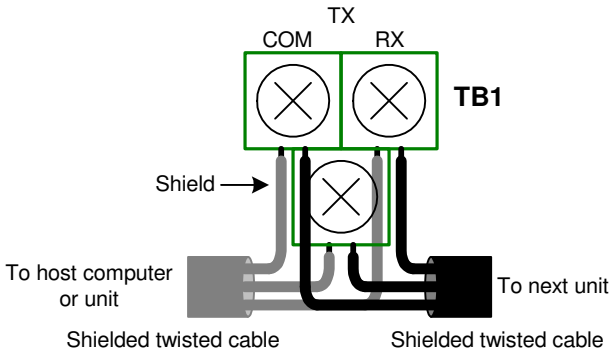


Fig. 11-3

CAUTION

- ✓ Separates the communication cable from the main circuit cable and other power cables.
- ✓ A shielded twisted pair wire should be used for connecting TB1 and the host computer. Connect the twisted pair cable's shield to the COM terminal of TB1.
- ✓ When using several slave units, set JP3 of last unit to 'LD' position to connect the terminating resistors as shown in the Fig. 11-3.
- ✓ When connecting the TB3 and shielded twisted pair cable, do not solder the wires, which are exposed after the sheath is peeled off.
- ✓ If the communication is distorted and not carried out properly because of noise. Connect a ferrite core to the cable and increase the noise resistance. If required take other precautions for noise resistance / reduction.

11-4 Communication specifications

Connection method	: RS485, 2-wire type
Transmission distance	: Total extension distance less then 300mt (1000ft)
Baud rate	: Select from 1200, 2400, 4800, 9600, 14400, 19200bps
Transmission method	: Start-stop synchronization, half-duplex communication
Frame configuration	: Start - 1 bit Data - 8 bits Stop: 1 bit (with parity) or 2 bits (if no parity) Parity: Select from none, odd or even
Error detection	: Sum check, parity, framing
Communication protocol	: Modbus-RTU communication
Number of stations	: Set between 1 and 247

The default factory settings are shown below.

C401	Baud Rate	bps	=4: 9600
C402	Station Number		1
C403	Parity		=1: No Parity
C404	Response Time	Sec	0.01

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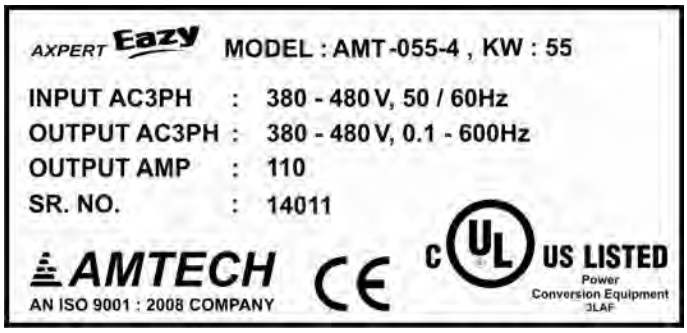
CHAPTER-12: UL INSTRUCTIONS

The *Axpert-Eazy* Series AC Variable Frequency Drives AMT-055-4 to AMT-355-4 complies with UL508C and CSA C22.2 No.14.

The UL and cUL marks are indicated on the rating nameplate for UL compliant parts.



Observe the following matters when using the inverter as an UL/cUL Standard compatible product.

(1) Use the inverter in an installation environment, where maximum surrounding air temperature does not exceed 50 Degree C.

(2) For the main circuit connected to the inverter, use a "75℃ CU" "voltage rating 600V or higher" copper wire.

(3) Use the wire sizes given in Table 2-1 for the main circuit wiring. Use a UL/CSA Listed round crimp terminal, which matches the wire diameter for the terminal connection. Crimp the crimp terminal with a crimping tool recommended by the maker.

(4) When wiring the circuit, tighten with the torque given in Table 2-1.

(5) Always provide a UL Certified fuse on the input side of the inverter. When protected by Class fuse as indicated below, these devices have the following short circuit rating.

Table 12-1

Model AMT-xxx-4	Fuse Rating (A rms)	Fuse Class	Short circuit current
055	150A, 600VAC	Class J	10,000A
075	200A, 600VAC	Class J	10,000A
090	250A, 600VAC	Class J	10,000A
110	300A, 600VAC	Class J	10,000A
132	350A, 600VAC	Class J	10,000A
160	400A, 600VAC	Class J	18,000A
200	500A, 600VAC	Class J	18,000A
250	600A, 600VAC	Class J	18,000A
315	700A, 600VAC	Class T	30,000A
355	800A, 600VAC	Class T	30,000A

(6) Install the inverter as “open type equipment".

(7) The installation environment must satisfy "pollution degree 2".

(8) The inverter has a motor overload protection function. Refer to Chapter 6, and set parameters B301 to B305 correctly.

(9) Integral solid-state short circuit protection does not provide branch circuit protection. Branch circuit protection must be provided in accordance with the National Electric Code and any additional local codes or equivalent.

CHAPTER-13: CE MARKING

The *Axpert-Eazy* Series AC Drive complies with the EMC Directives and Low Voltage Directives. Observe the following matters when using the inverter as an EMC Directive compliant product.

This Instruction details how to meet the EMC directives (89/336/EEC) with *Axpert-Eazy*. It is important to understand before installation and operation of drive. The *Axpert-Eazy* is designed to meet the EMC directives and are suitable for use in the Industrial Environments. These drives have been tested with the power cables and control leads connected as shown in Fig. 13-1. If these drives are connected with fewer control leads than these examples, it may be possible to reduce installation costs by using ordinary cables rather than screened cables which are recommend in this manual. It is strongly advised however that a compliance test should be performed under the actual operating conditions to certify that the system complies with the relevant EMC requirements. If the drives are used with any of the optional cards, you must provide suitable extra measures and must certify through a test that the product, system or installation complies with the relevant EMC requirements.

This instruction also details how to use filters for the installation where the drives are installed as stand-alone equipment without being fitted into any enclosure, and the installation where the drives are installed inside a metal enclosure.

WARNING

- ✓ This manual represents Amtech's recommendations based on its understanding of the EMC regulations only and Amtech cannot accept responsibility for any legal problems arising from or in connection with the use of its products.

- ✓ Amtech have made every effort to ensure that their products comply with the directives laid out in the certificate of conformity, which is supplied with each drive. In the case of EMC, the testing has been carried out using the filters, which are recommended for each product.

The EMC directives set out immunity requirements for the electrical drive (ability to work properly without being affected by external electromagnetic disturbance), in addition to the previously enforced emission requirements (electromagnetic disturbance generated by the electrical drive).

In addition to the radiated noise directly generated from the drive and its connected cables, the emission requirement includes the conducted noise, which is conducted outside the drive through the input cables.

Immunity is the ability of a drive to operate properly without being affected by an external disturbance.

The EMC compliance is only achieved when the drive's immunity level exceeds its emission level under its operating environment.

In addition to the immunity against a radiated and conducted disturbance, the EMC directive also requires of the drive the immunity against static electricity discharges and fast transients.

A human body can easily be charged with static electricity by merely walking on carpet and with a mere touch on the drive, this static electricity will be discharged through it. A discharging spark can be at such a magnitude that it can damage the drive.

A drive which is installed near cables connected to a switching inductive load can often operate incorrectly due to a fast transient induced on its control leads at a switching of the inductive load.

These are just a few examples of disturbance to which the drive is exposed, and the drive is now required to operate correctly without being affected by such disturbance.

13-1 Installation environments

The *Axpert-Eazy* conforms to the EN 61800-3 Category C3. Installing *Axpert-Eazy* with stand-alone is recommended to use in Industrial Environment, ensure that no device or equipment is installed adjacent to the drive that is intended for the Residential, Commercial and Light Industrial Environments only, as interference with such equipment may occur.

13-2 Input filters and their connections

⚠ WARNING

- ✓ Electrical shock hazards. The input filter terminals must be fully covered with appropriate insulation material to avoid electrical shocks.

- ✓ Electrical shock hazards. The input filters must be fully earthed. Otherwise, there may be a risk of electrical shocks and the effectiveness of filters will be impaired.

In most cases, the input filter should be installed as closely, approximately 0.5 meter (20") to the drive as possible to ensure its effectiveness. This may be changed, if, for instance, a complete system is filtered in its entirety. In this case, the whole system would require testing to ensure EMC compliance.

Ensure that the input filter is securely and effectively earthed. If the drive is installed on a metal plate, install the filter on the same plate and then earth the plate. This is effective to reduce EMI.

13-3 Wiring & Earthing

- ✓ Select the input cables from those specified in the manual
- ✓ The output cable from the drive must be screened or armored and the screen or armor must be connected to the earth as shown in fig. 13-1
- ✓ Ensure that the input and output cable are not installed in parallel to each other. Keep them apart from each other by at least 0.5 meter (20")
- ✓ Ensure that the screen of the output cable is earthed at both ends with one end connected to the drive's earth terminal and the other end to the motor earth
- ✓ Arrange the termination at the drives end inside the enclosure. If it is not possible to terminate the cables inside the enclosure then terminate them as closely to the drive's conduit hole as possible (preferably within 0.1 meter (4"))
- ✓ If the screened output cables are over 5 meters (16.6'), this may cause a problem arising from a floating capacitance, such as undesirable surge voltage increase at the motor terminals, electrical noises from the cables when they discharge capacitance, or increase in leakage currents. In this case, it is recommend to use output chokes
- ✓ Use a 0.13mm^2 (AWG 26) to 0.8mm^2 (AWG 18) wire for wiring to the control circuit and should be screened if they are used for a speed setting circuitry, analogue signal circuitry for metering, or relay signal circuitry. The screen should be connected to the drive's earth or COM terminal only (refer to Fig. 13-1)
- ✓ Control cables should be selected in accordance with the instructions in the drive's manual. The control leads should be wired away from the power cables. If it is not possible, cross them at the right angle, and if they are laid down alongside each other, ensure to separate them by at least 0.5 meter (20")
- ✓ When the section, which runs along the power cables, exceeds 10 meter (33.3'), separate them further more. The control cables should not share the same conduit hole of the drive with the power cables. Separate analogue control leads from relay control leads
- ✓ To reduce emission and to increase immunity, ensure that no control cables are connected that is not used. Also, wire them in such manner that they are as short as possible
- ✓ Put the relay signal controller and analog speed-setting controller, analog signal meters in a metal box
- ✓ Keep the earthing cable of drive, motor and filter as short as possible and is installed in accordance with the local requirements. Use low impedance earthing cables

✓ If the motor does not share the same earth post with the drive and filter, do not connect the screen / earth cable of the drive's output cable to the motor

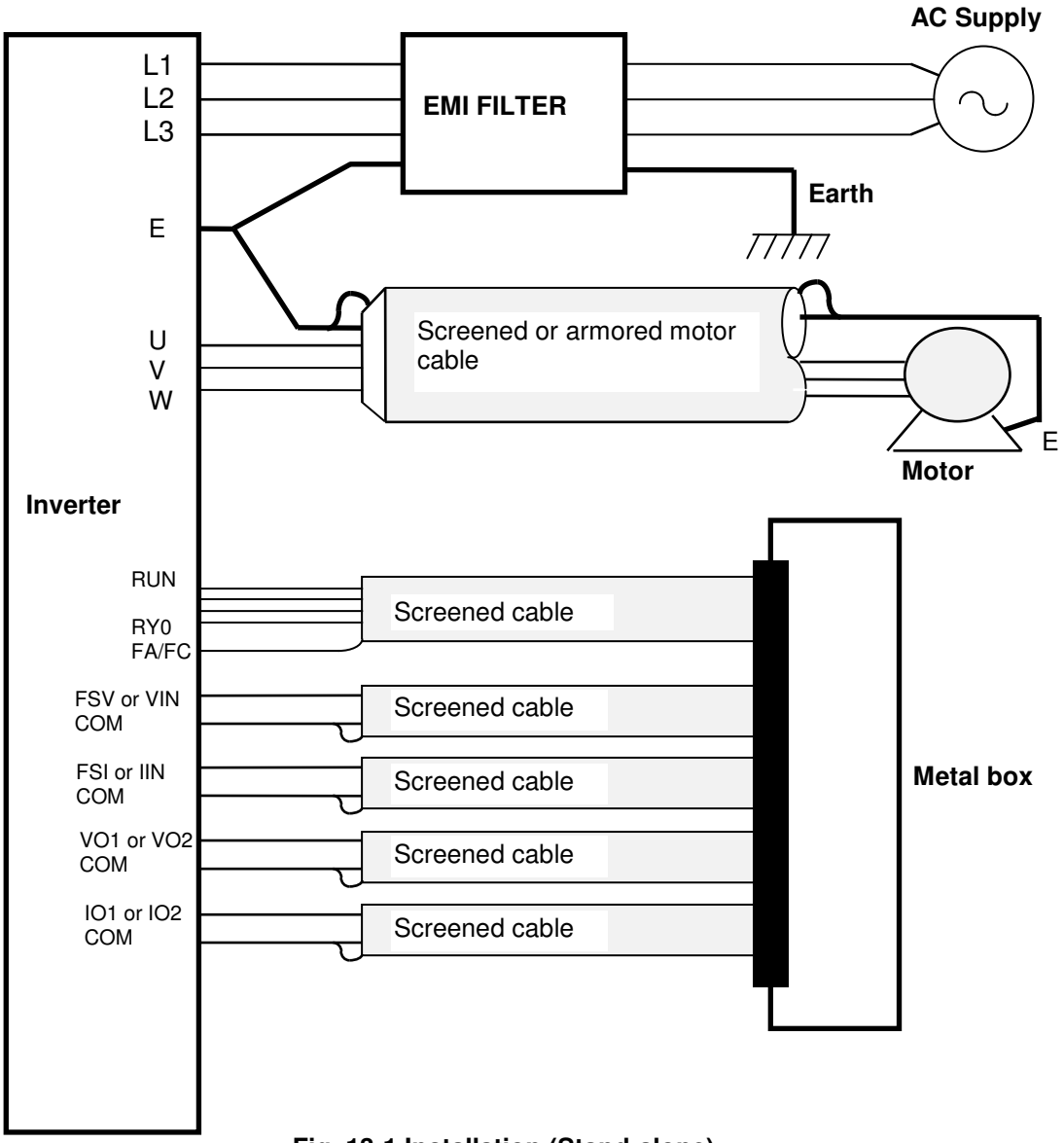


Fig. 13-1 Installation (Stand-alone)

13-4 Considerations to measuring devices

All the cables and leads connected to the drive or filter should be regarded as active sources of electrical noise. For inspection or service, use measuring devices or equipment that are CE marked. If they require an external power supply, use one, which is separate or well insulated from that of the drive system.

Even for a system that comprises CE marked equipment and devices only, an EMC compliance test may be required if the whole system is exported from one country to another. Ask the local government for details.

13-5 Installation into a metal cabinet

(1) Install the drive unit in a metal cabinet and put the EMI filter on the power source cable as shown in Fig. 13-2.
(2) The power source cable and motor cable outside the metal cabinet should be shielded and as shortest as possible. Electrically connect the shield to the earth terminal of the motor.

(3) It is not necessary to use shielded cables for the control circuit wiring inside the metal cabinet. However, make the EMI filter power source cable and the motor cable as short as possible, and separate them as far from each other as possible.
(4) In order to suppress the noise emission from the cables, earth the shield of the power source cable and motor cable to the metal cabinet with metal clamps.
(5) Use the shielded cables for the drive control wiring and earth the shield to the metal cabinet with a metal clamp.

EN 61800-3 Category C3 conformity is achieved by grounding the unit to the metal cabinet.

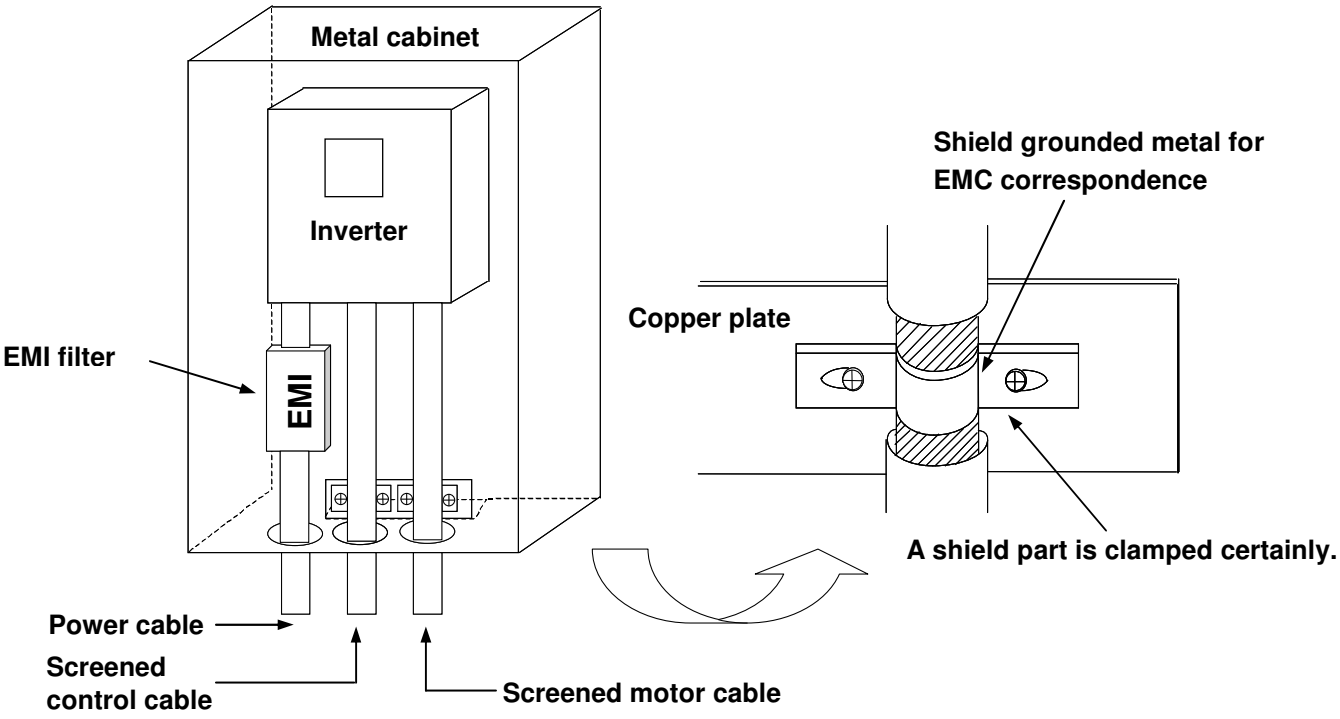


Fig.13-2

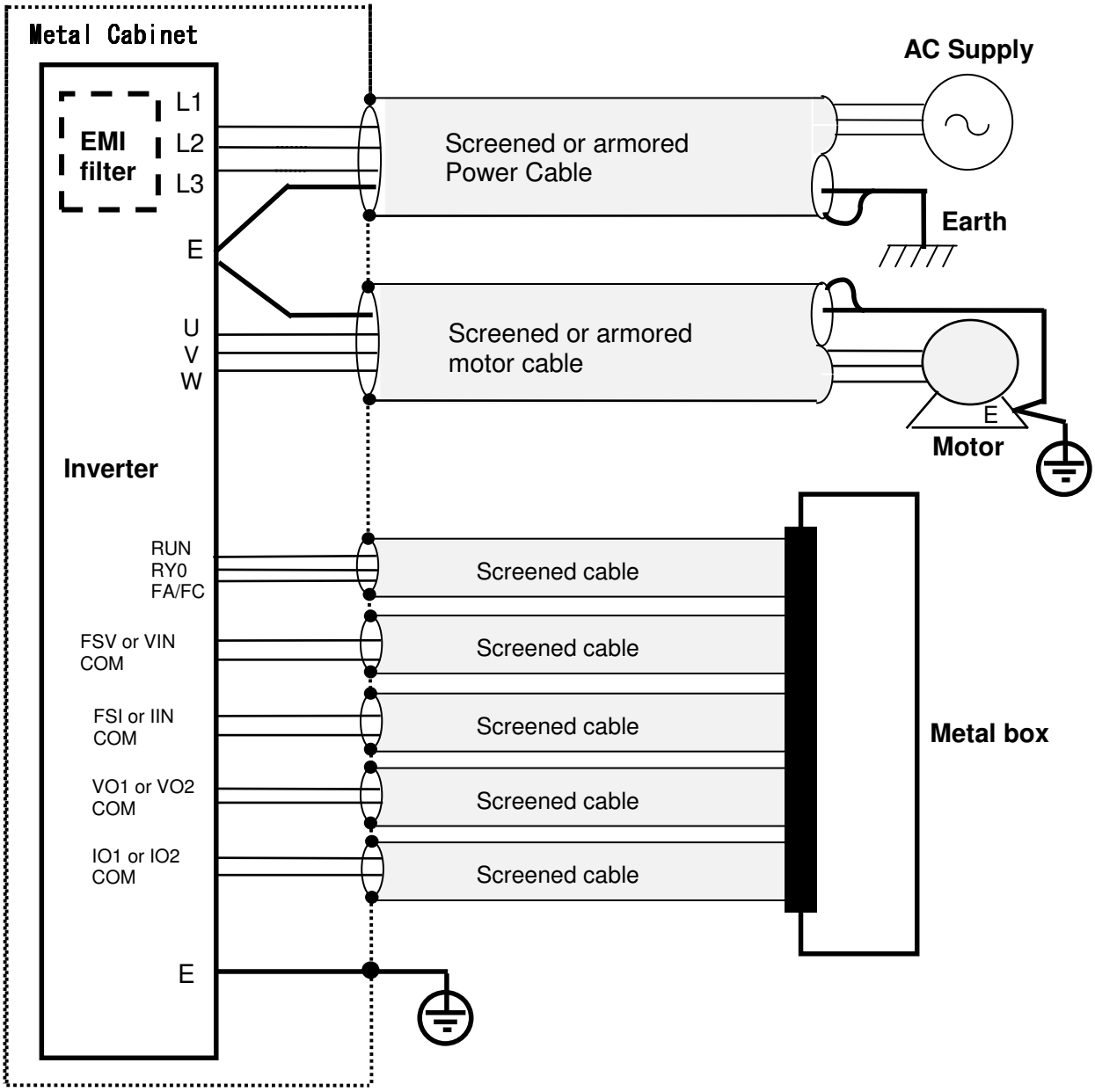


Fig. 13-3

13-6 Insulation test

CAUTION

- ✓ If an insulation test is performed on a system incorporating Eazy drive and filters, remove the input filters from the system during the test. (For precautions for drive, see Chapter 2.)
- ✓ Perform the test at the maximum voltage of 1500 VAC.

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Appendix-A: Standard Specifications

Power Source		380 ~ 480VAC, 3-Phase, 3-Wire, 50/ 60 Hz																					
Tolerance		Voltage tolerance: ±10%, Frequency tolerance: ±5%																					
AMT-XXX-4		037	045	055	075	090	110	132	160	200	250	315	355	400	450	500	630	710	800	900	11E	14E	15E
Normal Duty	Rated Capacity (Hp)	50	60	75	100	125	150	175	215	275	335	420	475	535	600	670	845	950	1075	1200	1500	1875	2075
	Max Continuous Rated Current (A) **(Note: 1)**	72	87	110	147	175	215	245	320	360	470	530	600	704	800	844	1067	1205	1440	1613	1992	2500	2700
	Max Applicable Motor (kW) **(Note: 2)**	37	45	55	75	90	110	132	160	200	250	315	355	400	450	500	630	710	800	900	1120	1400	1550
	Overload Current Rating	120% for 60 seconds, 140% for 2.5 seconds																					
Heavy Duty	Rated Capacity (Hp)	40	50	60	75	100	125	150	175	215	275	335	420	475	535	600	670	845	950	1075	1200	1500	1875
	Max Continuous Rated Current (A) **(Note: 1)**	60	72	87	110	147	175	215	245	320	360	470	530	600	704	800	844	1067	1205	1440	1613	1992	2500
	Max Applicable Motor (kW) **(Note: 2)**	30	37	45	55	75	90	110	132	160	200	250	315	355	400	450	500	630	710	800	900	1120	1400
	Overload Current Rating	150% for 60 seconds, 175% for 2.5 seconds																					
Power Source		500 ~ 575VAC, 3-Phase, 3-Wire, 50/ 60 Hz																					
Tolerance		Voltage tolerance: ±10%, Frequency tolerance: ±5%																					
AMT-XXX-5		037	045	055	075	090	110	132	160	200	250	315	355	400	450	500	630	710	900	10E	12E	14E	15E
Normal Duty	Rated Capacity (Hp)	50	60	75	100	125	150	175	215	275	335	420	475	535	600	670	845	950	1200	1340	1675	1875	2075
	Max Continuous Rated Current (A) **(Note: 1)**	54	73	87	110	135	150	175	215	290	345	390	430	485	540	670	720	950	1060	1335	1400	1680	1720
	Max Applicable Motor (kW) **(Note: 2)**	37	45	55	75	90	110	132	160	200	250	315	355	400	450	500	630	710	900	1000	1250	1400	1550
	Overload Current Rating	120% for 60 seconds, 140% for 2.5 seconds																					
Heavy Duty	Rated Capacity (Hp)	40	50	60	75	100	125	150	175	215	275	335	420	475	535	600	670	845	950	1200	1340	1675	1875
	Max Continuous Rated Current (A) **(Note: 1)**	46	54	73	87	110	135	150	175	215	290	345	390	430	485	540	670	720	950	1060	1335	1400	1680
	Max Applicable Motor (kW) **(Note: 2)**	30	37	45	55	75	90	110	132	160	200	250	315	355	400	450	500	630	710	900	1000	1250	1400
	Overload Current Rating	150% for 60 seconds, 175% for 2.5 seconds																					
Power Source		600 ~ 690VAC, 3-Phase, 3-Wire, 50/ 60 Hz																					
Tolerance		Voltage tolerance: ±10%, Frequency tolerance: ±5%																					
AMT-XXX-6		037	045	055	075	090	110	132	160	200	250	315	355	400	450	500	630	710	900	10E	12E	14E	17E	18E
Normal Duty	Rated Capacity (Hp)	50	60	75	100	125	150	175	215	275	335	420	475	535	600	670	845	950	1200	1340	1675	1875	2275	2415
	Max Continuous Rated Current (A) **(Note: 1)**	46	54	72	87	110	135	150	175	215	290	345	387	426	482	537	662	713	941	1058	1327	1396	1680	1720
	Max Applicable Motor (kW) **(Note: 2)**	37	45	55	75	90	110	132	160	200	250	315	355	400	450	500	630	710	900	1000	1250	1400	1700	1800
	Overload Current Rating	120% for 60 seconds, 140% for 2.5 seconds																						
Heavy Duty	Rated Capacity (Hp)	40	50	60	75	100	125	150	175	215	275	335	420	475	535	600	670	845	950	1200	1340	1675	1875	2275
	Max Continuous Rated Current (A) **(Note: 1)**	37	46	54	72	87	110	135	150	175	215	290	345	387	426	482	537	662	713	941	1058	1327	1396	1680
	Max Applicable Motor (kW) **(Note: 2)**	30	37	45	55	75	90	110	132	160	200	250	315	355	400	450	500	630	710	900	1000	1250	1400	1700
	Overload Current Rating	150% for 60 seconds, 175% for 2.5 seconds																						

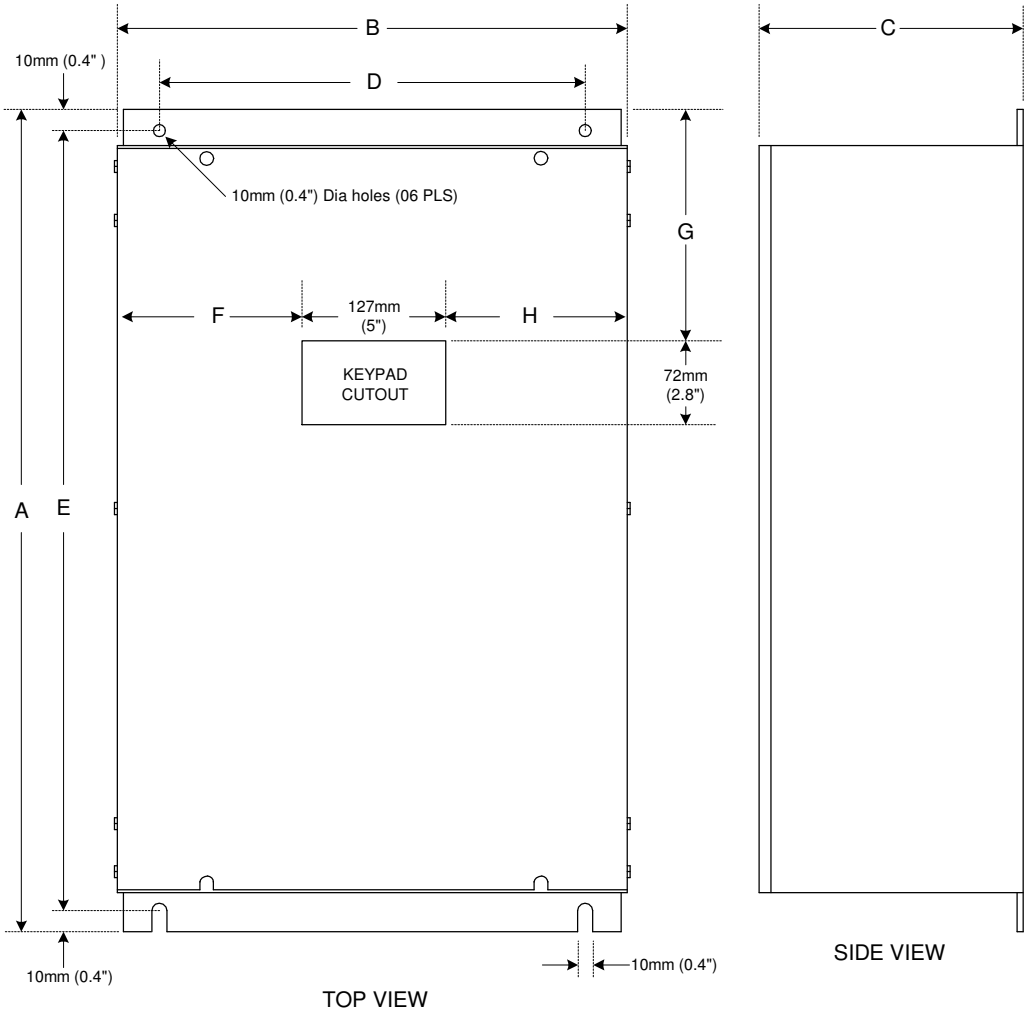
A

Control Functions	Control Method	Digital Space Vector PWM Control
	Frequency Range	0.1 ~ 600 Hz for V/F Control
	Frequency Accuracy	Digital references: ±0.01% (0 ~ 50ºC) / Analog References: ±0.01% (0 ~ 50ºC)
	Output Frequency Resolution	0.0001 Hz (20-bit)
	Frequency Setting Resolution	0.01 Hz Digital, 0.012 Hz/ 50 Hz Analog (12-bit)
	V/ Hz Characteristics	2-Preprogrammed patterns, 1-Custom 3-point setting pattern
	Torque Boost	Manual / Automatic Selective: 0~20%
	Acceleration/ Deceleration Time	0.1~ 6,00,000 Seconds
		Linear or S-Curve selective
	Skip Frequency	Three frequencies can be set, band can be set up to 10.0 Hz
	Slip Compensation	Slip compensation frequency up to 5.0 Hz
	Carrier Frequency **(Note: 3)**	Default: 5 kHz, 2~10 kHz up to AMT-250-4, Default: 4 kHz, 2~6 kHz for AMT-315-4 and higher, 500V and 600V systems.
Operation Specifications	Speed Search Function	Allows the drive to start with rotating machine without damage / tripping. Bump less transfer for redundancy application (Optional)
	Power Loss Carry Through	Up to 5 seconds for smooth operation of system during power loss
	DC Braking	DC Braking start frequency 0.1~50 Hz, Time: 0~25 seconds, Brake current: 15 to 150%
	Frequency Setting Input	Digital Operation Panel (Keypad)
		Potentiometer: 2 k Ohm
		Programmable Analog Inputs
		Static Pot: Frequency Increase/ Frequency Decrease using digital inputs
		Preset Speeds: Using digital inputs Preset input-0, 1 & 2
		* PLC Analog output –1, 2, 3 & 4
		Serial RS-485
	Torque Setting Input	Digital Operation Panel (keypad)
		Potentiometer: 2 k Ohm
		Programmable Analog Inputs
		* Static Pot: Frequency Increase/ Frequency Decrease using digital inputs
		* Preset Speeds: Using digital inputs Preset input-0, 1 & 2
		* PLC Analog output –1, 2, 3 & 4
		Serial RS-485
	Programmable Analog Inputs	FSV: 0~5 Vdc or 0~10 Vdc (or Inverse)
		FSI: 0~20 mA or 4~20 mA (or Inverse)
		VIN: 0~10 Vdc (or Inverse)
		IIN: 0~20 mA or 4~20 mA (or Inverse)
	Digital Inputs	8-Programmable Sequence Inputs, Sink / Source changeable
		Programmable to 35 different options: Not Used, Jog Select, Ramp Select, Preset i/p-0, Preset i/p-1, Preset i/p-2, Freq Increase, Freq Decrease, Aux Drive, Emergency Stop, Fault Reset, Ext Fault, Reverse, Terminal, Ref Select 0, Ref Select 1, PR Step Skip, PR Step Hold, PR/RSF Reset, PID Bypass, PID Disable, * Emergency Stop-NC, * Ext Fault-NC, * Run, * Stop, * Drive Enable-NC, * Drive Enable-NO, * PLC input 1, * PLC input 2, * PLC input 3, * PLC input 4, * PLC input 5, * PLC input 6, * PLC input 7 and * PLC input 8

Operation Specifications	Digital outputs	4-Programmable Sequence Outputs, open collector type	
		Programmable to 32 different options: Not Used, Run, Local, Reverse Run, I-Detection, Freq Attain, Speed Detect1, Speed Detect2, Acceleration, Deceleration, Aux Drive, Timer Output, Zero Speed, Fault Alarm, PID Up Limit, PID Lo Limit, Temp Alarm, Ready, Pump-1, Pump-2, Pump-3, Pump-4, Doff-End Alarm, Sleep Mode, * Fault, * PLC Output 1, * PLC Output 2, * PLC Output 3, * PLC Output 4, * PLC Output 5, * PLC Output 6, * PLC Output 7 *PID F/B ULmt and *PID F/B LLmt	
	Potential Free Contacts	3-Programmable relays:	1-NO, 1-NC for 2A @ 240 VAC
			Programmable to 32 different options same as digital outputs
	Programmable Analog Outputs	2-Programmable analog voltage outputs VO1 & VO2: 0~10 Vdc	
		2-Programmable analog current outputs IO1 & IO2: 4~20 mA	
		Programmable between 14 different options: Output Frequency, Output Current, Output Power, Output Voltage, DC Bus Volt, PID Output, Heatsink temperature, PLC Analog Output 1, PLC Analog Output 2, PLC Analog Outpu3, PLC Analog Output 4, Torque Current, Excite Current and Set Frequency	
	Network connectivity	RS-485 for PC Interface with Modbus-RTU protocol as standard	
	Auto Restart	Adjustable up to 10 times for ten faults	
	PID Controller	Inbuilt PID can be used as stand alone	
Display	Display and Keypad unit	Total 80-Character, 4-Line LCD panel with backlit, 8-Key keypad, 3-Status indicating LED for Run, Stop and Fault. Simultaneous display of eight selectable monitor parameters from Output frequency, RPM, Current, % Current, Set frequency, PID Reference, PID Feedback, Input voltage Vry, Input voltage Vyb, Output voltage, DC Bus voltage, kW, kWH, MWH, Heat sink temperature ℃ and ℉	
Protective Specifications	Protective Function	Current Limit, Over current fault, Timed over current fault, Load side short circuit fault, Under current fault, DC Bus Over voltage fault, DC Bus Under voltage fault, Temperature fault, Output phase loss fault, Earth (Ground) fault, External fault, Charging fault, Current sensor fail fault, EEPROM fault, 4~20mA reference missing fault, Auto tuning fault, Emergency stop, Communication loss, Output unbalance current fault.	
	Smooth Operation	Speed Search, Auto Restart and Power Loss Carry Through functions, Heat sink over temperature alarm	
	Fault history	Last ten faults with status and eight operational parameters like output frequency, output current, dc bus voltage and heat sink temperature, Input voltage, Total ON Time, kWH, MWH.	
Environment	Installation location	Indoor	
	Vibration	As per EN 60068-2-6, Acceleration: 1g, Frequency: 10 Hz ~ 150 Hz	
	Ambient temperature	0~50℃ (32 ~ 122℉), Open chassis module from 400 kW onwards	
	Storage temperature	-20℃ (-4℉) ~70℃ (158℉)	
	Altitude (above sea level)	1000 m (3300 ft) without derating, above this derate 5% per 305 m (1000 ft)	
	Humidity	0~95% maximum non-condensing	
	Enclosure	IP00	

Consult Amtech for the details on models AMT-011-X to AMT-030-X
The input power factor is 0.9 with 3% ACL
The inverter efficiency will be >98%
Note1: Indicates the total effective value including the higher harmonics
Note2: The maximum applicable motor output is given for a standard 4-pole motor.
Note3: If the default carrier frequency is exceeded, derate the output current by 5% per 1kHz as the reduced rating.
* Applicable only in control version 7.02 and thereafter.

Outline Dimensions



400 Volt Series

Model	Dimensions in mm (inch)								Weight in kg (lb)
	A	B	C	D	E	F	G	H	
AMT- 011- 4	470 (18.5)	250 (9.8)	262 (10.3)	197 (7.8)	439 (17.3)	61.5 (2.4)	81 (3.2)	61.5 (2.4)	18 (39.7)
AMT- 015- 4									
AMT- 018- 4									
AMT- 022- 4									
AMT- 030- 4	585 (23.0)	250 (9.8)	300 (11.8)	197 (7.8)	565 (22.2)	61.5 (2.4)	186 (7.3)	61.5 (2.4)	31 (68.3)
AMT- 037- 4									
AMT- 045- 4									
AMT- 055- 4									
AMT- 075- 4	700 (27.6)	322 (12.7)	365 (14.4)	217 (8.5)	680 (26.8)	98 (3.9)	145 (5.7)	98 (3.9)	45 (99.2)
AMT- 090- 4									
AMT- 110- 4	970 (38.2)	360 (14.2)	365 (14.4)	255 (10.0)	940 (37.0)	127 (5.0)	238 (9.4)	106 (4.2)	76 (167.6)
AMT- 132- 4									
AMT- 160- 4									

AMT- 200- 4 **AMT- 250- 4**	1185 (46.6)	481 (18.9)	321 (12.6)	400 (15.7)	1155 (45.5)	167 (6.6)	431 (17.0)	187 (7.4)	103 (227.0)
AMT- 315- 4 **AMT- 355- 4**	1330 (52.4)	506 (19.9)	321 (12.6)	400 (15.7)	1300 (51.2)	155 (6.1)	528 (20.8)	224 (8.8)	138 (304.2)
AMT- 400 - 4 ~ **AMT- 15E- 4**	Consult *AMTECH* or nearest dealer for the dimension								

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500 and 600 Volt Series

Model	Dimensions in mm (inch)								Weight in kg (lb)
	A	B	C	D	E	F	G	H	
AMT- 011- 5, AMT- 015- 5, AMT- 018- 5, AMT- 022- 5, AMT- 030- 5 AMT- 011- 6, AMT- 015- 6, AMT- 018- 6, AMT- 022- 6, AMT- 030- 6, AMT- 037- 6									
	595 (23.4)	291 (11.5)	300 (11.8)	236.5 (9.3)	574.5 (22.6)	82.5 (3.2)	142.5 (5.6)	80.5 (3.2)	22 (48.5)
AMT- 037- 5, AMT- 045- 5, AMT- 055- 5 AMT- 045- 6, AMT- 055- 6, AMT- 075- 6									
	679.5 (26.7)	290 (11.4)	300 (11.8)	236.5 (9.31)	659.5 (26.0)	82.5 (3.2)	227.5 (9.0)	80.5 (3.2)	28.5 (62.8)
AMT- 075- 5, AMT- 090- 5, AMT- 110- 5 AMT- 090- 6, AMT- 110- 6, AMT- 132- 6									
	906 (35.7)	368.5 (14.5)	364.5 (14.3)	313 (12.3)	876 (34.5)	121 (4.8)	375 (14.8)	120 (4.7)	65 (143.3)
AMT- 132- 5, AMT- 160- 5 AMT- 160- 5, AMT- 200- 6									
	970 (38.2)	360 (14.2)	364 (14.3)	255 (10.0)	940 (37.0)	127 (5.0)	236.5 (9.3)	105.5 (4.2)	77.4 (170.6)
AMT- 200- 5, AMT- 250- 5, AMT- 315- 5 AMT- 250- 6, AMT- 315- 6, AMT- 355- 6									
	1247 (49.0)	506 (19.9)	321 (12.6)	400 (15.7)	1217 (47.9)	154.5 (6.0)	460 (18.1)	224.5 (8.8)	117.7 (259.4)
AMT- 355- 5~AMT- 15E- 5 AMT- 400- 6~AMT- 18E- 6 Consult *AMTECH* or nearest dealer for the dimension									

Appendix-B: Fault Codes

Sr. No.	Fault Name	Fault Description
1	**Over Current Fault**	This fault indicates that the unit has tripped due to excessive over current (200% of the rated current). This is very fast acting. A short circuit condition on the output will also cause the unit to display this fault.
2	**Timed Over Current Fault**	This fault Indicate that the output current exceeded the thermal operation time having inverse time characteristics. When Normal-duty is set, the standard characteristics are 120% for one minute in respect to the motor rated current value and 140% for 2.5 seconds. When Heavy-duty is set, the standard is 150% for one minute in respect to the motor rated current value and 175% for 2.5 seconds. The timed over current counter starts after 100% load current for Normal -duty and 105% load current for Heavy-duty.
3	**Adjustable Over Current Fault**	This fault occurs when load current cross the adjustable over current level programmed in *B302* for 50msec.
4	**Under Current Fault**	This fault occurs when the load current falls below the programmed under current level (*B304)* for 1 second after reaching set speed.
5	**Current Sensor Fail**	It indicates that one or more current sensor has failed.
6	**Over Voltage Fault**	This fault occurs when the dc link voltage exceeds 785VDC for 400V series, 965VDC for 500V series and 1160VDC for 600V series level may be due to increased mains voltage or regeneration. If this fault occurs. The fault is instantaneous in order to protect the unit. Over voltage can be a serious condition and can lead to failure of the semiconductor components. When an over voltage fault occurs, the cause should be investigated and promptly corrected.
7	**Under Voltage Fault**	This fault indicates that the unit has shut down due to the dc bus voltage being low (below the under voltage level) after PLCT time *(C509)* for 3msec.
8	**Charging Fault**	This fault occurs when dc bus voltage doesn't reach at preset level within 5 sec after power ON.
9	**Output Phase Loss**	This fault indicates that the one of the output phase has lost its current flow (below 5%) and so the other two phases has over loaded (>70%) for *five cycles*. This fault will not occur during speed search operation. It can be disabled using *C307.* ***Note that this fault will not occur if the output terminals are open circuit.***
10	**Reference Missing**	This fault occurs if the analog current input (4-20mA) falls below 3mA for *80msec* when it is selected as reference source.
11	**External Fault**	This fault occurs if the external fault input selected at the terminal is missing. This comes from the user.
12	**Temperature Fault**	This fault occurs if heat sink temperature ≥90 ℃ or <0℃ for 2 second. In cases of multiple Inverter Units, this fault is for the first Inverter Unit. This fault will also come if one or more temperature switch is open.
13	**Auto Tuning Fault**	This fault indicates that the unit has failed in the auto tuning process.
14	**Emergency Stop**	This fault indicates that the unit has shut down due to the emergency stop command.
15	**EEPROM Fault**	This fault indicates that the data received from the EEPROM is incorrect. After reset, it will store default values in the EEPROM memory.
16	**Ground (earth) Fault**	This fault indicates that the unit has shut down due to ground fault. This fault comes, when the earth current is higher then the value set in *B306* for *100 msec.* Before reset, check that any output is not shorted with the ground. Set to 0% to disable the function.
17	**Communication Loss**	If the slave (main control unit) is not responding to the master (Digital Operation Panel), this fault will occur. It is auto reset type. If the

Sr. No.	Fault Name	Fault Description
		communication resumes, this will be cleared. In this fault, the AC DRIVE functioning will be affected only if *C405=1*.
18	**Output Current Unbalance**	This fault indicates that the unbalance in output current between any two-output phases is higher then the set value in *B314* for *10sec*. Set to 0% to disable the function.
19	**Input Phase Loss ***	This fault indicates that the unit has shut down due to the mains failure. One or more phase has failed or voltage is below 300Vac for *1.5sec*. Set to 0% to disable the function.
20	**Input Phase Sequence Fault ***	This fault indicates that the input phase sequence is reverse. This condition is checked for 500msec and after that fault will come. To reset the fault, switch off the mains and correct the phase sequence. Set to 0% to disable the function.
21	**Driver Fault**	This fault indicates that problem in either driver card or connection between control and driver card.
22	**Speed Deviation Fault**	This fault occurs when the speed command and speed detection difference is higher than the set level in *B612* for *1sec.* This fault is applicable in closed loop V/f, closed loop vector control and sensor less vector control mode is selected.
23	**Over Speed Fault**	This fault occurs when the detection speed is equal to or higher than the set level in *B611* for *1sec*. This fault is applicable in closed loop V/f, closed loop vector control and sensor less vector control mode is selected.
24	**IU-2 Temperature Fault****	This fault occurs if heat sink temperature ≥90 °C or ≤0 °C for 2 second of respective inverter unit.
25	**IU-3 Temperature Fault****	
26	**IU-4 Temperature Fault****	
27	**IU-5 Temperature Fault****	
28	**DU-1 Temperature Fault ****	This fault occurs if heat sink temperature ≥90 °C or <0 °C for 2 second of respective diode unit.
29	**DU-2 Temperature Fault****	
30	**IU-1 Current Sensor Fail****	It indicates that one or more current sensor has failed of respective inverter unit.
31	**IU-2 Current Sensor Fail****	
32	**IU-3 Current Sensor Fail****	
33	**IU-4 Current Sensor Fail****	
34	**IU-5 Current Sensor Fail****	
35	**IU-1 I-Unbalance Fault****	This fault indicates unbalance in output current of the Inverter Units. If due to the unbalance, the output current of one or more Inverter Unit exceeds its rated current for 60 second, this fault will come. The rated current of each Inverter Unit is 600A for 400V Series and 387A for 500/600V Series.
36	**IU-2 I-Unbalance Fault****	
37	**IU-3 I-Unbalance Fault****	
38	**IU-4 I-Unbalance Fault****	
39	**IU-5 I-Unbalance Fault****	

* This Fault is only applicable in control version 3.17 and thereafter.
** This Fault is only applicable in control version 7.05 and thereafter when multiple inverter units (IU) are used.

Appendix-C: Trouble Shooting Guidelines

In case of fault condition, first ensure that the mains voltage applied at L1, L2 and L3 are ok.
Then check the control supply voltage in PCA-2014A/ PCA-2004A.

Sr. No.	Measure @		Expected Voltage
1	1,J8	4,J8	+20V ~ 25.5VDC
2	2,J8	4,J8	+14.9 ~ 15.1VDC
3	3,J8	4,J8	+4.5 ~ 5.5VDC
4	5,J8	4,J8	-13.5 ~ 16.5VDC
5	3.3VD	DGND	+3 ~ 3.6VDC
6	1.9VD	4,J8	+1.86 ~ 1.94VDC

If the above voltages are correct, check the following jumper positions.

Jumper Position
1. The equipment is shipped with JP2 in **10V** position. When connecting potentiometer at FSV or using 0-10V signals, ensure that JP2 is put in the **10V** position.

2. The equipment is shipped with sink logic (JP1 is kept on **Sink** position) for the programmable sequence inputs. To change the sink logic to source, change the jumper JP1 position to **Source**.

3. The equipment is shipped with JP3 in **NLD** position. This means the terminating resistors are not in picture. To insert the terminating resistors, keep the jumper to **LD** position.

If the above jumper positions are correct, check the following as per the fault displayed on the Operation Panel (LCD Display)

No.	Fault Name	Causes & Countermeasures
1	**Over Current Fault**	If fault comes during stop condition, 1. The power module(s) in the main circuit may be damaged. Switch off the power supply and check the power module(s). 2. There may be loose connection or improper connection of current sensor cable or shorting in the cable. Switch off the power supply and remove the cable. Check again. If no fault is observed, there can be a problem in cable or connection. Check the cable on both the sides for proper crimping. Insert the cable properly and check again. If still problem persist, replace the cable. 3. Current sensor may have failed. Switch off the power supply and remove current sensor. Check again. If no fault is observed identify the damaged current sensor and replace it. 4. The fault may be from Driver Board side. Switch off the power supply and remove the FRC in case of wire interface. Check the cable on both the sides for proper crimping. Insert the cable properly and check again. If the fault persists, proceed for the next step. In case of fiber optic interface, remove all the fiber optic cables, check them and insert them again properly. Check again. If the fault persists, proceed for the next test. 5. IGBT Gate Driver board may have problem. Replace the IGBT Gate Driver board and check again. Take anti-static precautions while changing the board. If fault occurs during acceleration when the motor is connected, 1. Make sure that the parameters are set properly. Abnormal setting of

		V/F, Torque Boost, Acceleration time, Speed search function related parameters and current limit may result in over current or damage to the power devices. 2. Increase the acceleration time (A201 / A203). 3. Reduce torque boost settings (A501 / A502) If fault occurs during normal run with load condition, 1. A sudden change in the load or short circuit may have occurred at output. Reduce the load fluctuation and/ or any short circuit condition at the output. 2. If the current fluctuation is observed, adjust the DTC gain B111 such that the fluctuation disappears. 3. One or more current sensor may be partially damaged. Measure the voltage at pin-3, 7 and 11 of connector J12 with respect to 4,J8 in PCA-2014A/ PCA-2004A. When the measured output current is balance, the voltage level at these pins should be approx. equal. If any output observed uncommon, replace the respective current sensor and check again. 4. Check the value of snubber capacitors mounted on the IGBT and replace if found abnormal. 5. IGBT driver may have problem. Remove fiber optic signal for error in PCA-2004A. The light should be coming out of the cable. If not, the problem may be from driver board. Replace the driver board and check. If fault occurs during deceleration, 1. Increase the deceleration time (A202 / A204). 2. Abnormal setting of DC braking parameters can result in over current fault during deceleration. Reduce the dc braking start frequency (A306) and dc braking time (A308) settings if used.
2	**Timed Over Current Fault**	1. The AC DRIVE may have overloaded. Ensure that motor current data are properly set in B103. Reduce the load or increase the motor and AC DRIVE capacity 2. If this occurs at low speed, reduce the torque boost settings (A501 / A502) or DC braking settings (A307 / A308)
3	**Adjustable Over Current Fault**	1. The motor current data are set incorrectly. Set correct motor current data in B103. 2. The adjustable over current settings are too low. Increase the adjustable over current level (B302). 3. The output current is too high. Reduce the motor load. 4. Disable the feature by setting 300% in B302.
4	**Under Current Fault**	1. Under Current Limit B304 is set too low. 2. Disable the feature by setting 0% in B304.
5	**Current Sensor Fail**	1. Loose connection of hall current sensor cable connected at J12 of PCA-2014A/ PCA-2004A. Switch off the unit and remove the cable. Check for proper crimping of cable on both sides. If found abnormal, replace the cable and check again. 2. One or more current sensor has failed. Remove connector J12 and reset the fault. If the fault can be reset, find out which current sensor has failed. 3. If after removing connector J12, the problem persists, replace PCA–2014A/ PCA-2004A.
6	**Over Voltage Fault**	1. The power supply voltage may have risen above 785VDC for 400V series, 965VDC for 500V series and 1160VDC for 600V series. Reduce the voltage to within the specified range. 2. The speed may be fluctuating. Adjust B111 to prevent the hunting of motor. 3. If the fault is coming during deceleration, the load GD2 may be too

		large. Set the ramp down time according to the load GD2. 4. Loose connection of dc bus voltage feedback at J9 of PCA-2014A/ PCA-2004A. Ensure proper connections. 5. Check the value of snubber capacitors mounted on the IGBT and replace if found abnormal.
7	**Under Voltage Fault**	1. DC Bus voltage may have fallen below the under voltage level. A drop in voltage, phase dropout or power supply failure may have occurred. Check the input power supply and correct it if necessary. 2. Loose connection of Input voltage feedback at J10 of PCA-2004A. Ensure proper connections of input voltage feedback.
8	**Charging Fault**	1. The dc bus voltage didn't reach to predefined voltage level within 5 sec after power up. - Soft charge resistor may be open. - One or more phases may have failed. - Dc bus voltage feedback may be missing. Ensure proper connection of dc bus voltage feedback at J9.
9	**Output Phase Loss**	1. There may be a single phasing of the motor. Disconnect and check the motor. 2. One or more output cables are open or loose connected. Check the output connections and correct it. 3. There may be problem in current sensors. 4. Disable the feature using *C307.*
10	**Reference Missing**	1. Analog current input reference (4-20mA) to the unit is below 3mA. Check the voltage level at FSI terminal of PCA-2014A/ PCA-2004A
11	**External Fault**	1. The signal for the external fault is present at the PSI. Check and correct it. 2. If the signal is not present, remove the selection of the external fault with the help of Mode-C parameters. 3. There may be a problem in PCA-2014A/ PCA- 2004A. Remove the control board PCA-2014A/ PCA - 2004A.
12	**Temperature Fault**	1. A trouble may have occurred in the cooling blower. Replace it if necessary. 2. The ambient temperature may have risen. Lower the ambient temperature (less than 50 °C for 400V series or less than 40 °C for 500V / 600V series). 3. The carrier frequency may be set too high. 4. The temperature switch (thermostat) or thermistor is not connected or loosely connected at J16 and J13 respectively. Disconnect thermostat switch connection at J16 and ensure that the thermostat shows short circuit. Disconnect the thermistor and ensure that the thermistor shows resistance greater then 2.2kohm but less then 60kohm. Reconnect thermostat and thermistor properly.
13	**Auto Tuning Fault**	1. The auto tuning process has failed. The motor parameter setting value may be incorrect. - Set correct motor parameter. - Ensure that motor is directly connected to the inverter (remove any additional components if any like output choke etc. when performing auto tuning).
14	**Emergency Stop**	1. The signal for the emergency stop input is present at the PSI. Check and correct it. 2. If the signal is not present, remove the selection for emergency stop with the help of Mode-C parameters. 3. There may be a problem in PCA-2014A/ PCA-2004A. Remove the control board PCA-2014A/ PCA-2004A.
15	**EEPROM Fault**	1. Data received from the EEPROM is incorrect or out of range. On fault reset, default values will be stored in the EEPROM.

		Ensure proper earth connection to the unit and inside the unit. 2. If again fault occurs after power recycling, replace PCA-2014A/ PCA-2004A.
16	**Ground Fault**	1. Ground fault may have occurred in the output line or motor. Check that any output is not shorted with the ground. Partially damaged output cables can also lead to this condition. 2. One or more current sensor may have problem. Remove the current sensor feedback and check. 3. If still fault persists, replace PCA-2014A/ PCA-2004A; otherwise replace the problematic current sensor.
17	**Communication Loss**	1. Check the communication cable between master (LCD Display unit) and slave (Main control unit). 2. Disable the fault using C405. This will allow the inverter to run in case of communication loss between the PCA-2014A/ PCA-2004A DSP control board and PCA-2012 LCD display board. 3. There may be problem in display board PCA-2012. Replace the display board PCA-2012 and check again. 4. There may be problem in control board PCA-2014A/ PCA-2004A. If +5V supply or +3.3V supply is not coming then also this fault will come. Check the power supply unit and if found problem replace it or replace the DSP control board PCA-2014A/ PCA-2004A and check again.
18	**Output Current Unbalance**	1. Check the setting of B314. Correct the setting if it is too low. 2. Go through the below steps and if it does not help, disable it by setting 0% to B314. If fault occurs during acceleration when the motor is connected, 1. Make sure that the parameters are set properly. Abnormal setting of V/F, Torque Boost, Acceleration time and Speed search function related parameters and current limit may result in output current unbalance. 2. Increase the acceleration time (A201 / A203). 3. Reduce torque boost settings (A501 / A502). If fault occurs during normal run with load condition, 1. A sudden change in the load may have occurred at output. Reduce the load fluctuation at the output. 2. If the current fluctuation is observed, adjust the DTC gain B111 such that the fluctuation disappears. 3. One or more current sensor may be partially damaged. Measure the voltage at pin-3, 7 and 11 of connector J12 with respect to 4,J8 in PCA-2014A/ PCA-2004A. When the measured output current is balance, the voltage level at these pins should be approx. equal. If any output observed uncommon, replace the respective current sensor and check again. 4. Check the motor connection with inverter and at motor terminal. If any connection is open or loose, correct it. If fault occurs during deceleration, 1. Increase the deceleration time (A202 / A204). 2. Abnormal setting of DC braking parameters can result in unbalance current fault during deceleration. Reduce the dc braking start frequency (A306) and dc braking time (A308) settings if used.
19	**Input Phase Loss ***	1. A drop in voltage, phase dropout or power supply failure may have occurred. Check the AC input power supply, and remove such condition. 2. There may be loose connection at the input. Check for the proper input connections.

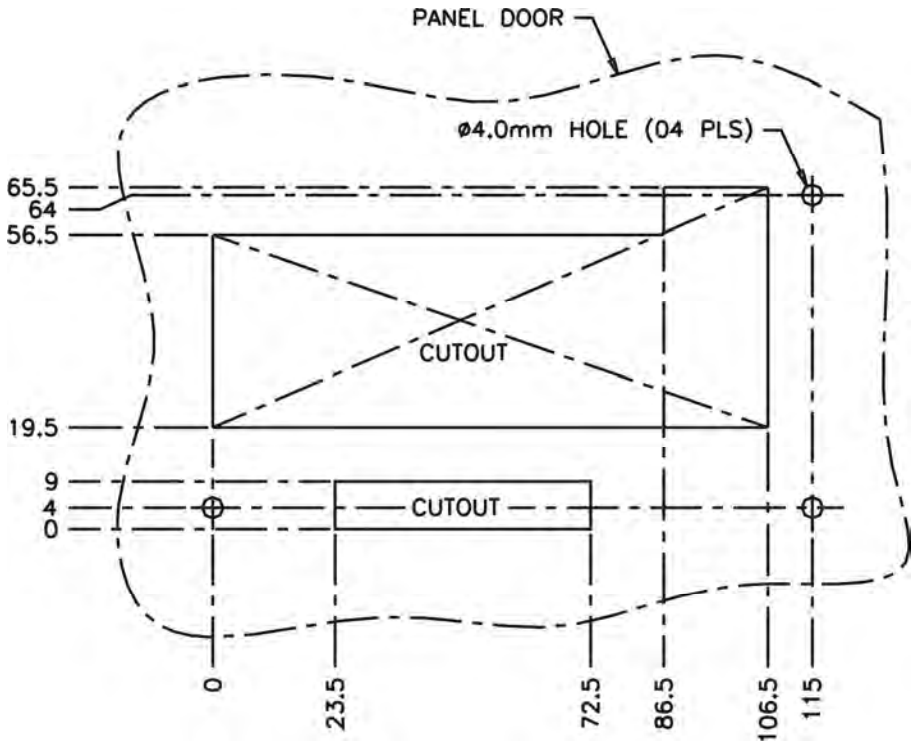
		3. The feedback at J10 in PCA-2004A is missing. Ensure correct wiring of PCA-2004A
20	**Input Phase Sequence Fault ***	1. Check the phase sequence of the mains power supply, if the phase sequence is reverse, change any two phases.
21	**Driver Fault**	1. The fault may be from Driver Board side. Switch off the power supply and remove the FRC in case of wire interface. Check the cable on both the sides for proper crimping. Insert the cable properly and check again. If the fault persists, proceed for the next step. In case of fiber optic interface, remove all the fiber optic cables, check them and insert them again properly. Check again. If the fault persists, proceed for the next test. 2. IGBT Gate Driver board may have problem. Replace the IGBT Gate Driver board and check again. Take anti-static precautions while changing the board. 3. Check the SMPS supply voltage.
22	**Speed Deviation Fault**	1. Check the encoder wiring. 2. Check the proper earthing of encoder. 3. Problem in auto tuning parameter. Enter the correct motor parameter and repeat the procedure for auto tuning.
23	**Over Speed Fault**	1. Check the encoder wiring. 2. Check the proper earthing of encoder. 3. Problem in auto tuning parameter. Enter the correct motor parameter and repeat the procedure for auto tuning.
24	**IU-2 Temperature Fault****	1. A trouble may have occurred in the cooling blower of respective Inverter or diode unit in case of parallel inverter. Replace it if necessary. 2. The ambient temperature may have risen. Lower the ambient temperature (less than 50 °C for 400V series or less than 40 °C for 500V / 600V series). 3. The carrier frequency may be set too high. 4. The thermistor is not connected or loosely connected at J16 of PCA-2014A and TB1 of PCA-2013A respectively. Disconnect the thermistor and ensure that the thermistor shows resistance greater then 2.2kohm but less then 60kohm. Reconnect thermistor properly.
25	**IU-3 Temperature Fault****	
26	**IU-4 Temperature Fault****	
27	**IU-5 Temperature Fault****	
28	**DU-1 Temperature Fault****	
29	**DU-2 Temperature Fault****	
30	**IU-1 Current Sensor Fail****	1. Loose connection of hall current sensor cable connected at J11 to J15 of PCA-2013A. Switch off the unit and remove the cable. Check for proper crimping of cable on both sides. If found abnormal, replace the cable and check again. 2. One or more current sensor has failed. Remove connector J11 to J15 and reset the fault. If the fault can be reset, find out which current sensor has failed. 3. If after removing connector J11 to J15, the problem persists, replace PCA- 2013A.
31	**IU-2 Current Sensor Fail****	
32	**IU-3 Current Sensor Fail****	
33	**IU-4 Current Sensor Fail****	
34	**IU-5 Current Sensor Fail****	
35	**IU-1 I-Unbalance Fault****	1. Check whether the sensors are connected properly or not. If the sensor of one or more Inverter Unit is not connected, this fault may come. 2. There may be problem with the driver board or fiber optic cable. Check the driver board and fiber optic connections. If required replace it. 3. There may be loose connection of the fiber optic cable or problem with the Fiber Optic Interface Board PCA-96A. Checks the connection with of the fiber optic cables are if required change the PCA-96A. 4. Check the current sensor connections at Driver Interface Board PCA-2013A. If required, change the board.
36	**IU-2 I-Unbalance Fault****	
37	**IU-3 I-Unbalance Fault****	
38	**IU-4 I-Unbalance Fault****	
39	**IU-5 I-Unbalance Fault****	

* This Fault is only applicable in control version 3.17 and thereafter.
** This Fault is only applicable in control version 7.05 and thereafter.

Remote mounting of Digital Operation Panel (keypad)

The Digital Operation Panel of *Axpert-Eazy* Series inverter modules can be extended to remote or panel. To extend the digital operation panel, order the display cable as per the required distance. Follow below steps to mount the Digital Operation Panel.

1. Open the front green cover mounted with four screws.
2. Digital Operation Panel is mounted on the card plate with the help of four M4 screws and display clamp. First remove the display cable from the Digital Operation Panel. Now, remove the Digital Operation Panel with display clamp from the card plate by opening four M4 screws.
3. Digital Operation Panel is mounted on the display clamp using four M4 nuts. Remove this clamp.
4. Put cutout (dimensions are given in the below fig) in the front door of the panel or wherever the digital operation panel is to be mounted.
5. Follow below sequence shown in the fig. to mount the Digital Operation Panel.
6. The keypad of the Digital Operation Panel is fitted on green plate. This plate has four M3 bolt, 10mm (0.4") long on the backside.
7. Insert these studs into the holes provided on the panel and fit it with the washer and nut.



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Appendix-D: Revision history

Sr. No	Control Version	Changes	Compatible display version	Effective date
1	7.04	– Incorporation of 500V and 600V series in new software. – Parameters (*A110* to *A112*) are added for speed reference selection using ref select 0 and ref select 1 through PSI – Added two sets in *B315* for copy-paste function and now there are total five sets of copy paste function – I-detection hysteresis level added in *C314*. – Torque current, excitation current and set frequency options added in *C201* to *C204* for analog outputs. – Two options added for dc bus voltage control in *B307*. – Default value of time constant changed from 50mS to 100mS for analog input in *C219* and *C220*. – Problem of 4-20mA ref loss during power on condition is resolved. – Selection is provided for stall current limit either from local or VIN in *A309*	7.04	19/02/2011
2	7.05	– Added functionality related to parallel inverters for higher capacity models. – Resolution changed from 1 to 0.1 for stall current limit (B301) and stall current limit auxiliary (D401). – The default value of slip frequency is changed from 0 to 2.0 Hz for V/F closed loop mode. – Torque mode selection option provided in PSI. – “RUN” Status provided in status code in Modbus parameter.	7.05	15/03/2011
3	7.06	– Redefined no. of IU & DU for model range from 800kW to 1400kW and added one more model 1550kW for 400V series AC drive. – Added two function 33: PID Feedback Upper Limit 34: PID feedback Lower Limit in all PSO. – Added encoder count (M217) parameter in the A601 ~ A608. – Defined inverter type KW (M305) parameter as per series name like AMT-XXX-4, AMT-XXX-5 and AMT-XXX-6. – Added one parameter (M710) to display driver fault status for Inverter unit (IU) units.	7.06	27/01/2012
4	7.08	– Changed default value of Local Set Frequency A101 and D201 are 10Hz. – Changed min value of parameters A107 is –200%, C205~C207 are 0.1, C208 is 100, C209 is 0.1, C210 is 100, C211 is 0.1, C213 is 0.1, C215 is 0.1 and C217 is 0.1. – Added new parameters A113, B117, B613, B614, B615, B710, C510 and C511.	7.08	01/11/2012

		– Changed default value of parameters B605 is 20, B606 is 0.8sec, B607 is 100% and C505 is 70%. – Changed Max value of parameters A601~A608 are 20, B605 is 100, C201~C204 are 15, C401 is 6 and C506 is 30sec. – When STOP key is pressed for 2.5 seconds or longer during operation, the drive will coast to stop regardless of Local or Terminal start control.		

Contact Us

AMTECH ELECTRONICS (INDIA) LTD.

E-6, GIDC Electronics Zone, Gandhinagar-382 028, Gujarat, India.
Phone : +91-79-23289101, 23289102, 23289103
Fax : +91-79-23289111
E-mail : info@amtechelectronics.com
Website : www.amtechelectronics.com

Rep/Distributor Address: