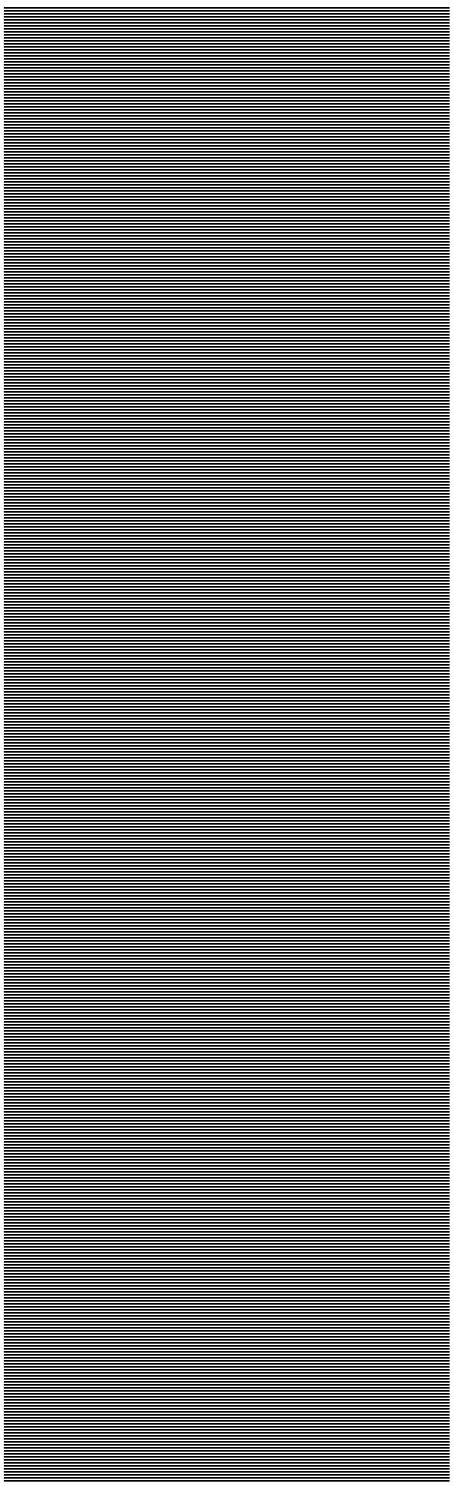


USERS MANUAL

MSX$_2$ SERIES SOFT STARTERS

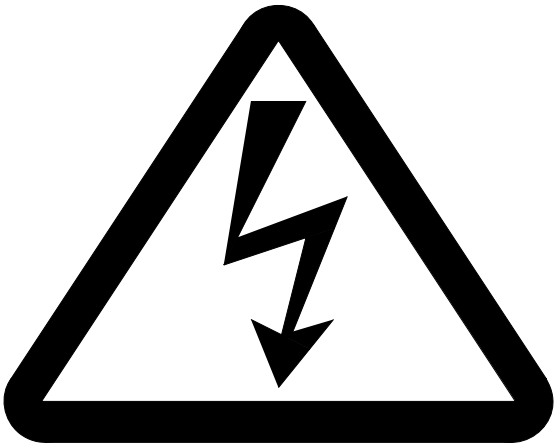
ENGINEERED MOTOR CONTROL

ELECTRONIC SOFT STARTERS AND A.C.SPEED DRIVES

READ MANUAL COMPLETELY PRIOR TO CONNECTING AND COMMISSIONING THIS EQUIPMENT

Fault finding and/or repair of this equipment must be undertaken only by suitably qualified personnel.

WARNING



LECTRICAL SHOCK HAZARD

ENSURE THE MSX$_2$ IS COMPLETELY ISOLATED FROM THE POWER SUPPLY BEFORE ATTEMPTING ANY WORK ON THE UNIT

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GETTING STARTED

THIS USERS MANUAL COVERS MSX2 MODELS
MSX2-0011 ⇨ MSX2-0372

The chart below shows the major activities necessary to install and commission the MSX2 Series starter. It is recommended that all users refer to at least the sections listed, before commencing work. First time users of soft start technology, or the MSX2 are strongly encouraged to read this Users Manual completely prior to installation or commissioning.

PHYSICALLY INSTALL THE STARTER

refer sections :

Physical Specification

⇩

CONNECT DESIRED POWER CIRCUIT

refer sections :

Electrical Connection (Power Circuits)

⇩

CONNECT DESIRED CONTROL CIRCUIT

refer sections :

Electrical Connection (Control Circuits)

⇩

COMMISSION STARTER

refer sections :

Commissioning Procedure
MSX2 Programming Procedure
Trouble Shooting

SECTION 1 CAUTION STATEMENTS

Overview : This section highlights potential causes of equipment damage

Content :

CAUTION

This caution symbol is used throughout the MSX2 Manual to draw special attention to activities which may result in equipment damage. A summary of these cautions is listed below.

Such Caution Statements cannot cover every potential cause of equipment damage but can highlight common causes of damage. It is therefore the installers responsibility to adhere to all instructions in this manual, to follow good electrical practice and to seek advice before operating this equipment in a manner other than as detailed in this manual.

- Ensure that the MSX2 is completely isolated from the power supply before attempting any work on the unit.
- Entry of metal swarf into the cabinet can cause equipment failure.
- Do not apply voltage to the MSX2 control input terminals. These are active 24VDC inputs and must be controlled with potential free circuits.
- Do not connect Power Factor Correction capacitors to the output of the MSX2. If static power factor correction is employed, it must be connected to the supply side of the MSX2.
- Before installing the MSX2 without a line contactor ensure such connection meets local regulations and by-laws.
- If installing the MSX2 within a non-ventilated enclosure a by-pass contactor must be utilised to prevent excessive heat build-up.
- Do not utilise the 6 Wire Motor Connection format without using a line contactor or no volt release circuit breaker.
- If installing a by-pass contactor ensure phase connections are correctly made

  ie L1-T1, L2-T2,L3-T3, or

  L1-L4, L2-L5, L3-L6, or

  1-2, 3-4, 5-6

The examples and diagrams in this manual are included solely for illustrative purposes. Users are cautioned that the information contained in this manual is subject to change at any time and without prior notice.

In no event will responsibility or liability be accepted for direct or indirect or consequential damages resulting from the use or application of this equipment.

SECTION 2 GENERAL DESCRIPTION

Overview : This section provides overview of MSX2 Seies

Content :

General Description

The MSX2 Series is a microcontroller based soft starter designed to simplify the installation and commissioning of reduced voltage starting systems.

The MSX2 Series soft starters offer users a complete solution for their soft starting. Units range from a low 9 Amps right through to 1393 Amp models, all of which, without adjustment, are suitable for use with a wide range of voltages and frequencies.

This Users Manual covers MSX2 Series models MSX2-0011 thru MSX2-0372.

In operation the MSX2 Series provides :

- soft start of motor and load
- reduced starting current
- soft stop of motor and load
- phase sequence protection
- prestart phase loss protection

In addition to these operational features the MSX2 Series soft starters perform many other sophisticated functions which enhance performance and make installation and commissioning very easy.

- automatic motor connection analysis and configuration
- automatic phase sequence analysis and configuration
- automatic supply voltage analysis and configuration
- automatic frequency analysis and configuration
- Uni-Start soft start
- current limiting
- full voltage starting
- three wire or six wire operation
- auto reset
- digital DIP Switch user adjustments
- Fault/Status Indication
- LED indicators
- Relay Outputs
  - Main Contactor Control Output
  - Bridging Contactor Control Output
  - Trip Output

SECTION 3 MSX2 FEATURE DESCRIPTIONS

Overview : This section describes the purpose and operation of each feature of the MSX2 Series Starters.

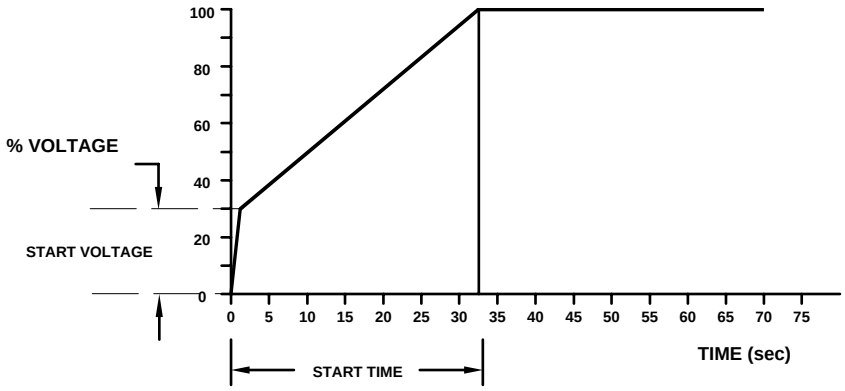
Content :

Uni-Start TVR Soft Start

Uni-Start TVR (Timed Voltage Ramp) soft start produces a fast voltage ramp up from zero to the required start voltage and then ramps at the user selected ramp rate up to full voltage.

A key feature of the MSX2 Series is the inclusion of Uni-Start technology. Uni-Start is an advanced method of control which dynamically adjusts starter output to match the motor characteristics as they change during starting and stopping. Uni-Start Control is operative in all start and stop modes.

This feature eliminates the motor instability sometimes experienced with ordinary soft start systems. Uni-Start TVR provides particular advantage in pumping applications where both starting and stopping times can be adjusted to minimise fluid hammer without the need for dedicated 'pump start' units.



START VOLTAGE is user selectable (10% - 70%). The adjustable start voltage enables the motor to quickly deliver breakaway torque without an excessive start torque or stall period.

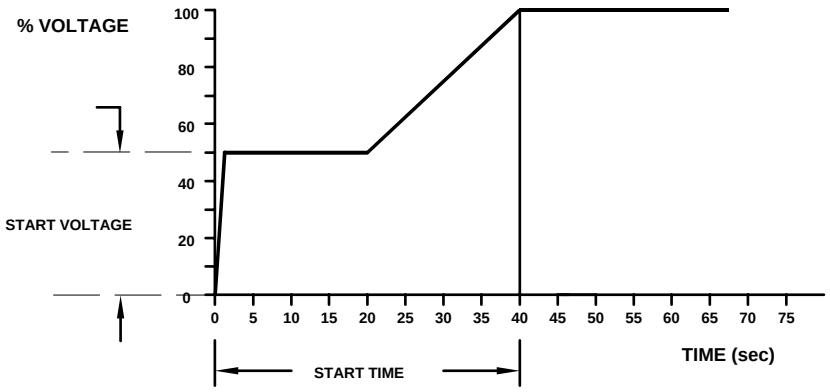
START RAMP TIME is user adjustable (2s - 62s). The actual setting required for an application is load and installation dependent and should be set to optimize the starting characteristics of the machine.

In order to start a low inertia machine a low start voltage and short ramp time would be appropriate, while a high inertia machine will require an elevated start voltage and extended ramp time. Current limit (TRI-SLOPE) often provides a better start for high inertia machines.

Current Limit (TRI-SLOPE)

Current Limit (TRI-SLOPE) is useful to limit the maximum starting current with high inertia loads. Use of an elevated start voltage and extended start ramp time will effectively limit the starting current to that required by the machine and motor to reach full speed.

Current Limit start mode produces a fast voltage ramp up from zero to the required start voltage, and then holds this voltage for half of the required start ramp time. The voltage then continues to be ramped up to full voltage.



START VOLTAGE is user selectable (10% - 70%). The adjustable start voltage enables the motor to quickly deliver breakaway torque without an excessive start torque or stall period.

START RAMP TIME is user adjustable (2s - 62s). Start Ramp Time is the total time taken for full voltage to be achieved. The actual setting required for an application is load and installation dependent and should be set to optimize the starting characteristics of the machine.

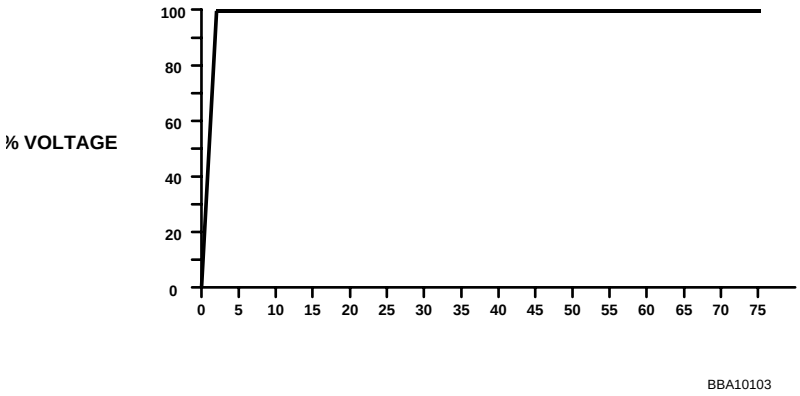
Full Voltage Starting

The full voltage starting option provides maximum starting torque for extreme loads but without the mechanical damage or electrical transients associated with DOL starting.

Voltage and torque are applied smoothly over approximately 3 seconds. If process requirements necessitate faster motor acceleration refer to your local representative.

The soft starter must be rated according to the connected motor's Locked Rotor Current (LRC). Refer to your local representative for advice.

To set the MSX2 Series for a full voltage start set the Start Voltage for 70% and the Start Ramp Time for 2 seconds.



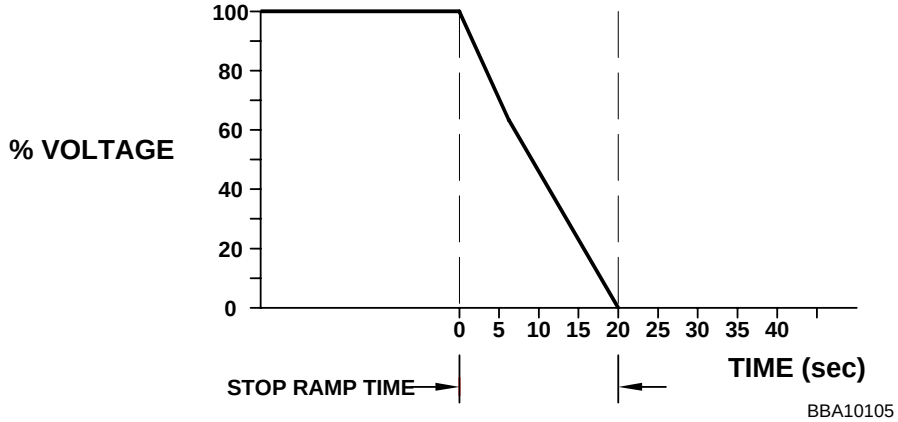
Uni-Stop Soft Stop

The MSX2 Series soft starters are equipped with a user selectable and adjustable Uni-Stop soft stop function (0s - 62s). Uni-Stop Soft Stop, when enabled, reduces the voltage applied to the motor, causing the motor to stall and decelerate to zero speed. The effect of this is to add inertia to the load and thereby reduce the rate of deceleration.

Uni-Stop Soft Stop technology dynamically adjusts starter output to match the motor characteristics as they change during stopping.

Uni-Stop Soft Stop eliminates the motor instability sometimes experienced with ordinary soft start and soft stop systems. Uni-Stop provides particular advantage in pumping applications where both starting and stopping times can be adjusted to minimise fluid hammer without the need for dedicated 'pump soft start' units.

If utilising the Uni-Stop Soft Stop function and a line contactor, the contactor must not be opened until the end of the stop ramp time.



Phase Sequence Protection

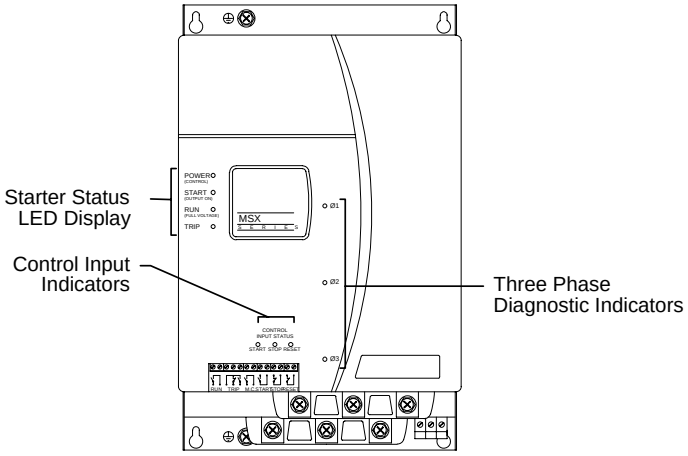
To prevent damage from reverse motor rotation caused by incorrect phase sequence of the incoming electrical supply, MSX2 Series starters provide User Selectable Phase Sequence protection.

Control Inputs

MSX2 Series starters provide three control inputs (Start, Stop and Reset). Refer to section 7 for futher information.

Indicators

Three groups types of indicator are offered by the MSX2 to provide information on starter, control input and power supply status.



A. Status LED Panel

1. Power (Yellow) : Control voltage is present.
2. Start (Green) : The MSX2 is supplying voltage to the output, and the Main Contactor (M.C.) relay is closed. The starter may be in the soft start, run or soft stop modes.
3. Run (Green) : The MSX2 is supplying full output voltage, and the Run relay is closed.
4. Trip (Red) : The MSX2 has tripped and is waiting either for a manual reset, or to time out and auto-reset. It also indicates status of the Trip relay output.

B. Control Input Indicators

1. Start (Yellow) : Indicates the Start input is closed.
2. Stop (Yellow) : Indicates the Stop input is closed.
3. Reset (Yellow) : Indicates the Reset input is closed.

C. Three Phase Diagnostic Indicators

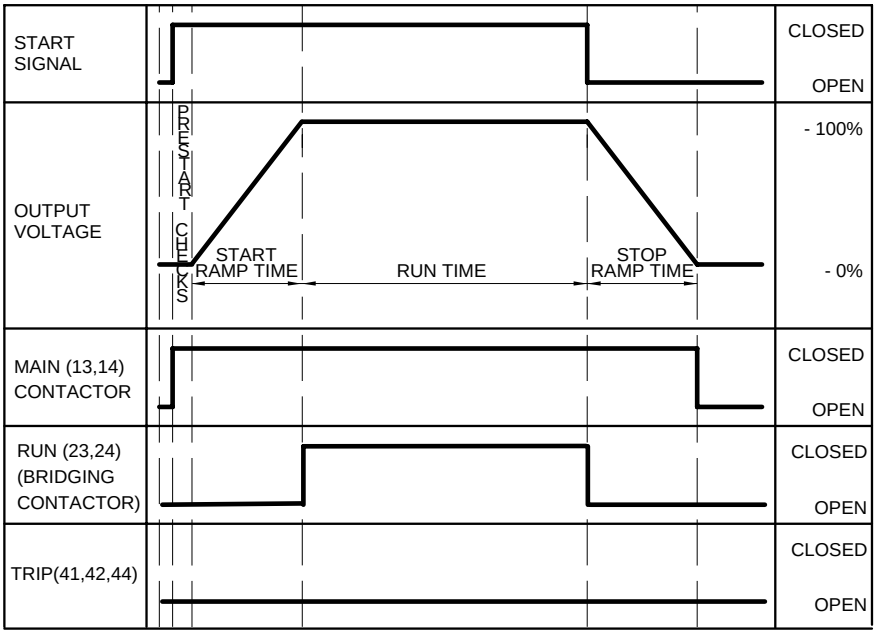
The three phase indicator LEDs indicate the voltage differential between the input and output voltage on each phase of the starter. Under normal conditions all three LEDs will be illuminated when the starter is in the OFF condition and will gradually dim as the output voltage increases during a start. The LEDs will completely extinguish when the MSX2 is delivering full output voltage.

1. When the unit is powered up but not running, the three LEDs should glow with equal brightness.
2. If the output voltage is not present on one or more phases, the corresponding LED will not glow.
3. If the output is open circuit on one or more phases, the corresponding LED will not glow.
4. If the voltage is low on one phase, one or more LEDs will glow at only reduced brightness.
5. If the MSX2 is incorrectly connected in the Six-Wire configuration, one or more LEDs will glow at only reduced brightness.
6. If an SCR has failed short circuit, the corresponding LED will not glow.

Relay Outputs

MSX2 Series starters provide three relay outputs.

- Main Contactor Control (M.C.)
- Run
- Trip

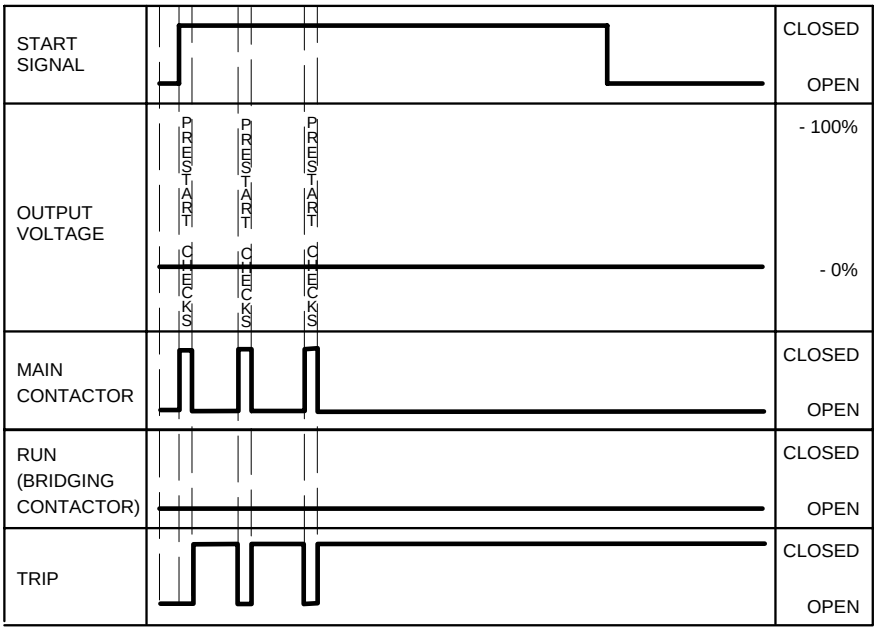


Prestart Circuit Analysis & Configuration

To prevent damage from incorrect installation or supply problems the MSX2 Series starters perform an automatic system analysis before each start. Tests include :

- Motor circuit
- Motor connection configuration
- Frequency range
- Voltage range
- Supply circuit
- Phase Sequence

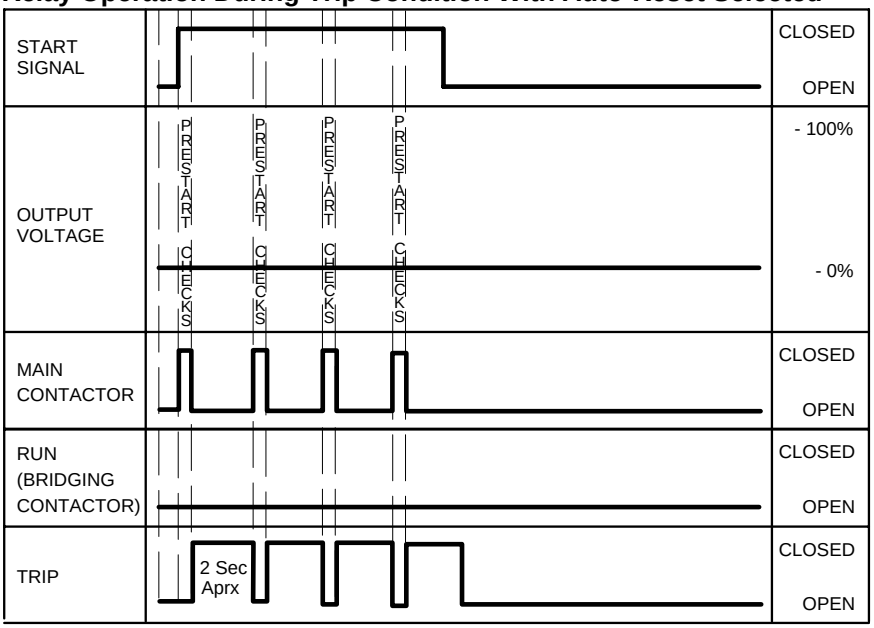
Upon successful completion of the tests voltage is applied to the motor.
The MSX2 will perform up to three Prestart Checks before tripping due to failure of any of the pre-start checks.



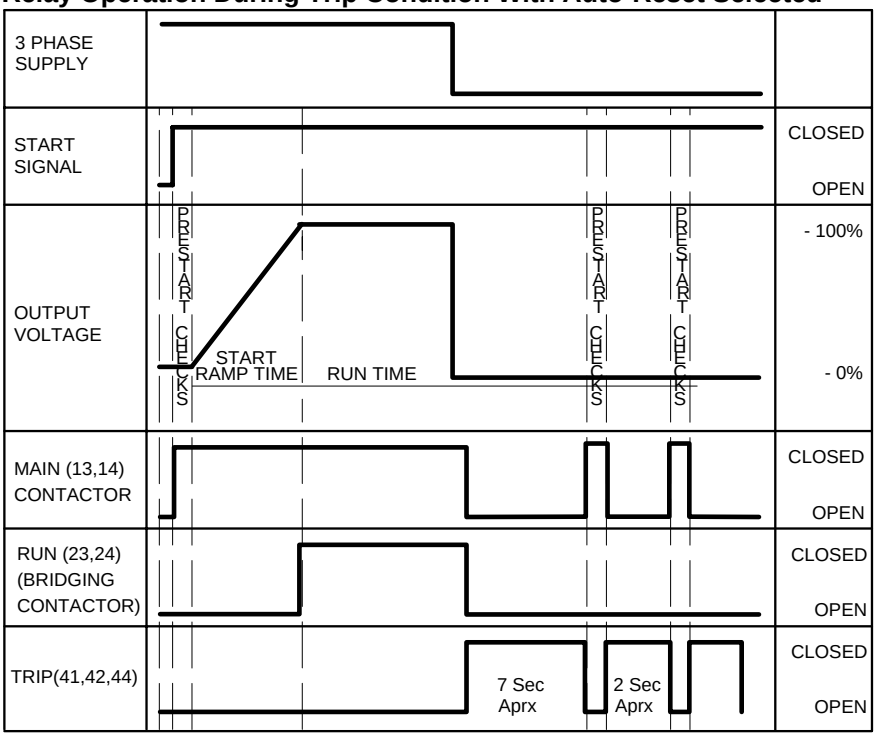
Auto Reset

This feature, if enabled, causes the soft starter to reset after a trip and if the start signal is still present, attempt a restart.

Relay Operation During Trip Condition With Auto-Reset Selected



Relay Operation During Trip Condition With Auto-Reset Selected



Auto-configuration

The MSX2 Series automatically determines the motor connection, supply frequency, supply voltage & phase sequence and configures the internal parameters for correct operation, or inhibits operation if a problem is detected.

At start, the soft starter is able to determine and configure for 3 Wire or 6 Wire operation. The MSX2 will auto-adjust for 50Hz (± 2Hz) or 60Hz(± 2Hz) will operate for line input voltages as follows :

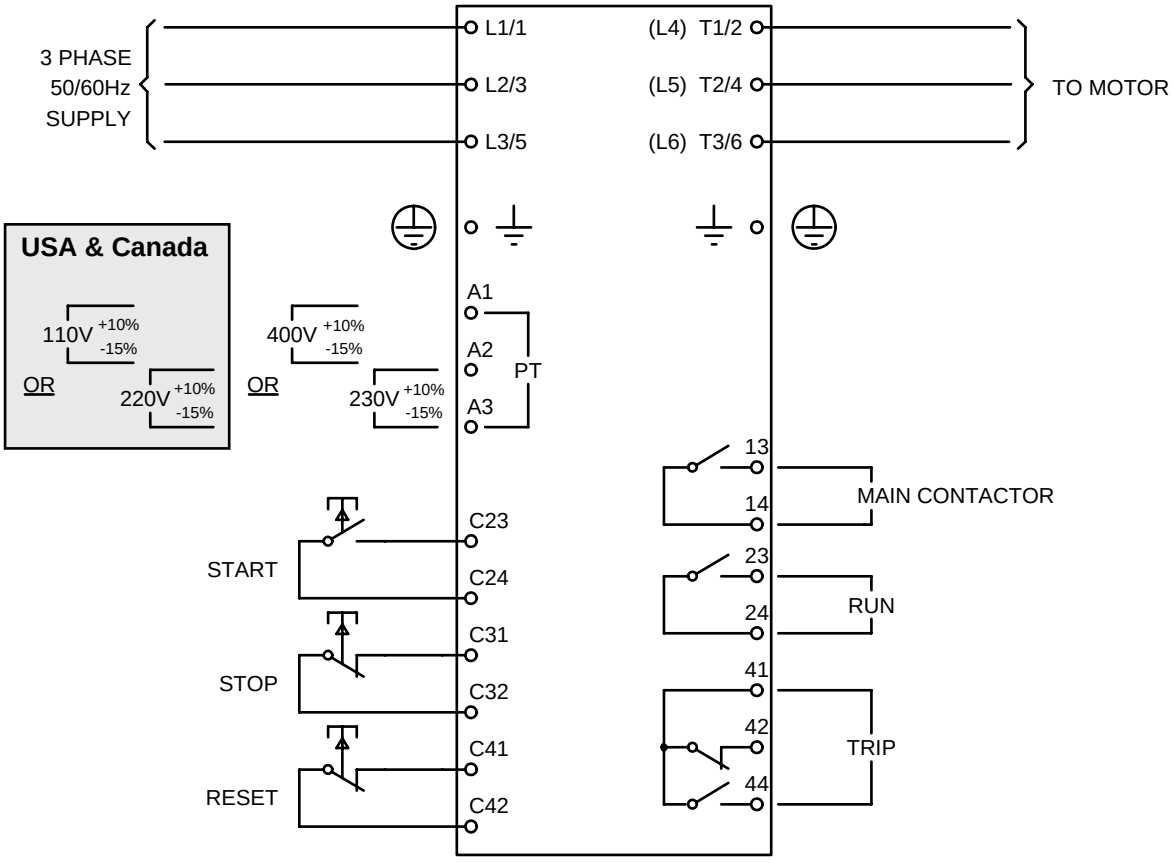
3 wire connection : 220 VAC to 600 VAC
6 wire connection : 220 VAC to 440 VAC

SECTION 4 ELECTRICAL SPECIFICATION

Overview : This section details the general electrical specification of the MSX2 Series Starters.

Content :

MSX2 CONNECTION DETAIL



SPECIFICATIONS The following specifications are common to all models:-

Power Circuit: Reverse parallel connected thyristors (full wave control)

Supply Voltage: 200 VAC to 600 VAC (3 Wire)
200 VAC to 440 VAC (6 Wire)
Consult local representative for other voltages

Supply Frequency: 48Hz to 52Hz, 58Hz to 62Hz

Control Voltage: 230/400V +10%/-15% or
110/220V +10%/-15% Refer Marking On Equipment

Current Rating: Refer to Table Of Ratings overleaf

Motor Connection: 3 Wire or 6 Wire

Control Inputs: Active 24 VDC, 8mA approx
(C23,C24) Start
(C31,C32) Stop
(C41,C42) Reset

Relay Outputs: 5A @ 250VAC/360VA, 5A @ 30VDC Resistive
(23,24) Run (Bridging Contactor Control) (N.O.)
(41,42,44) Trip (C/O)
(13,14) Main Contactor Control (N.O.)

Indicators: Starter Status
- Power On
- Start
- Run
- Trip

Control Input Status
- Start
- Stop
- Reset

Three Phase Diagnostic Indicators
- Phase 1, Phase 2, Phase 3

Environmental: Degree of Protection: IP00
Form Designation: Form 1
Rated Insulation Voltage: 2 kV
Rated Impulse Voltage: 2 kV
Pollution Degree: 3
Rated Short-circuit Current: 50 kA
Equipment Class (EMC): Class A.
This product has been designed for Class A equipment. Use of the product in domestic environments may cause radio interference, in which case the user may be required to employ additional mitigation methods.

Ambient Temperature: 0^{o}C to 45^{o}C (Operating)
-5^{o}C to 65^{o}C (Storage)

Approved To: UL508
CSA 22.2 No 14.
C✓ (CISPR-11)
CE (IEC947-4-2)

CONTINUOUS RATINGS

	60% DUTY CYCLE (Off Time = 145 seconds)					
	Light Load		Medium Load		Heavy Load	
	300% x FLC, 10 Sec 10 Starts/Hr AC53a 3-10:60-10		300% x FLC, 30 Sec 10 Starts/Hr AC53a 3-30:60-10		450% x FLC, 30 Sec 10 Starts/Hr AC53a 4.5-30:60-10	
	40°C	45°C	40°C	45°C	40°C	45°C
MSX2-0011	11	11	10	10	7	7
MSX2-0013	13	12	12	12	9	8
MSX2-0025	25	24	23	22	17	16
MSX2-0034	34	33	31	30	23	22
MSX2-0039	39	37	36	34	26	25
MSX2-0055	55	53	53	51	37	35
MSX2-0073	73	69	69	66	48	46
MSX2-0080	80	77	76	72	53	51
MSX2-0126	126	120	114	108	82	78
MSX2-0136	136	130	124	118	88	84
MSX2-0158	158	151	152	145	106	101
MSX2-0193	193	185	184	177	130	124
MSX2-0223	223	213	212	204	149	143
MSX2-0264	264	255	251	242	176	170
MSX2-0372	372	355	344	328	243	231

Multilpy by 1.5 for 6 Wire (Inside delta Connection) current rating.

	70% DUTY CYCLE (Off Time = 108 seconds)					
	Light Load		Medium Load		Heavy Load	
	300% x FLC, 10 Sec 10 Starts/Hr AC53a 3-10:70-10		300% x FLC, 30 Sec 10 Starts/Hr AC53a 3-30:70-10		450% x FLC, 30 Sec 10 Starts/Hr AC53a 4.5-30:70-10	
	40°C	45°C	40°C	45°C	40°C	45°C
MSX2-0011	11	10	10	9	7	7
MSX2-0013	12	12	12	11	9	8
MSX2-0025	24	23	23	22	16	16
MSX2-0034	33	31	30	28	22	21
MSX2-0039	37	35	34	32	25	24
MSX2-0055	55	52	52	50	37	35
MSX2-0073	71	68	68	64	48	45
MSX2-0080	79	75	74	71	53	50
MSX2-0126	121	115	110	104	80	76
MSX2-0136	131	125	120	114	86	82
MSX2-0158	156	149	150	143	105	100
MSX2-0193	190	183	182	175	129	124
MSX2-0223	219	210	210	201	148	142
MSX2-0264	260	251	248	239	175	168
MSX2-0372	362	346	336	321	239	228

Multilpy by 1.5 for 6 Wire (Inside delta Connection) current rating.

	80% DUTY CYCLE (Off Time = 73 seconds)					
	Light Load		Medium Load		Heavy Load	
	300% x FLC, 10 Sec 10 Starts/Hr AC53a 3-10:80-10		300% x FLC, 30 Sec 10 Starts/Hr AC53a 3-30:80-10		450% x FLC, 30 Sec 10 Starts/Hr AC53a 4.5-30:80-10	
	40°C	45°C	40°C	45°C	40°C	45°C
MSX2-0011	10	10	9	9	7	7
MSX2-0013	12	12	12	11	8	8
MSX2-0025	24	22	22	21	16	15
MSX2-0034	31	29	28	27	21	20
MSX2-0039	36	34	33	31	24	23
MSX2-0055	54	51	52	49	36	35
MSX2-0073	70	66	66	63	47	45
MSX2-0080	77	73	73	70	52	49
MSX2-0126	115	110	105	100	78	74
MSX2-0136	126	120	116	110	84	80
MSX2-0158	154	147	148	142	104	99
MSX2-0193	188	180	180	173	128	123
MSX2-0223	217	208	207	198	146	140
MSX2-0264	256	246	244	235	173	167
MSX2-0372	352	335	328	312	235	224

Multilpy by 1.5 for 6 Wire (Inside delta Connection) current rating.

	90% DUTY CYCLE (Off Time = 35 seconds)					
	Light Load		Medium Load		Heavy Load	
	300% x FLC, 10 Sec 10 Starts/Hr AC53a 3-10:90-10		300% x FLC, 30 Sec 10 Starts/Hr AC53a 3-30:90-10		450% x FLC, 30 Sec 10 Starts/Hr AC53a 4.5-30:90-10	
	40°C	45°C	40°C	45°C	40°C	45°C
MSX2-0011	10	9	9	9	7	6
MSX2-0013	12	11	11	11	8	8
MSX2-0025	23	22	21	20	16	15
MSX2-0034	29	28	27	26	21	20
MSX2-0039	34	32	31	30	24	23
MSX2-0055	53	50	51	48	36	34
MSX2-0073	68	65	65	62	46	44
MSX2-0080	75	71	71	68	51	49
MSX2-0126	109	104	101	96	75	71
MSX2-0136	120	115	111	106	82	78
MSX2-0158	151	144	146	139	103	98
MSX2-0193	185	178	178	171	127	121
MSX2-0223	213	203	204	196	145	138
MSX2-0264	251	242	240	231	171	165
MSX2-0372	340	324	318	303	230	219

Multilpy by 1.5 for 6 Wire (Inside delta Connection) current rating.

BYPASSED RATINGS

	2.5 STARTS PER HOUR					
	Light Load		Medium Load		Heavy Load	
	300% x FLC, 10 Sec 2.5 start/Hr AC53b 3-10:1430		300% x FLC, 30 Sec 2.5 start/Hr AC53b 3-30: 1410		450%, x FLC,30 Sec 2.5 start/Hr AC53b 4.5-30: 1410	
	40°C	45°C	40°C	45°C	40°C	45°C
MSX2-0011	14	13	12	12	8	8
MSX2-0013	14	14	14	13	10	9
MSX2-0025	31	30	29	28	20	19
MSX2-0034	47	45	44	42	30	29
MSX2-0039	52	50	48	46	33	32
MSX2-0055	59	56	57	54	39	37
MSX2-0073	79	76	75	72	52	49
MSX2-0080	88	84	83	80	57	55
MSX2-0126	160	153	144	138	99	95
MSX2-0136	160	153	145	139	100	95
MSX2-0158	166	159	160	153	110	105
MSX2-0193	202	194	194	187	135	130
MSX2-0223	237	227	226	218	157	150
MSX2-0264	282	272	269	259	186	179
MSX2-0372	418	400	387	370	266	254

Multilpy by 1.5 for 6 Wire (Inside delta Connection) current rating.

	10 STARTS PER HOUR					
	Light Load		Medium Load		Heavy Load	
	300% x FLC, 10 Sec 10 starts/Hr AC53b 3-10:350		300%, 30 Sec, 10 start/Hr 10 starts/Hr AC53b 3-30:330		450%, 30 Sec, 10 start/Hr 10 starts/Hr AC53b 4.5-30:330	
	40°C	45°C	40°C	45°C	40°C	45°C
MSX2-0011	13	13	12	11	8	8
MSX2-0013	14	14	13	13	9	9
MSX2-0025	30	29	27	26	18	18
MSX2-0034	45	43	39	37	26	25
MSX2-0039	50	47	43	41	30	28
MSX2-0055	59	56	56	53	38	37
MSX2-0073	79	75	73	70	50	48
MSX2-0080	87	83	81	77	56	53
MSX2-0126	155	148	133	127	91	87
MSX2-0136	157	150	138	132	95	90
MSX2-0158	165	158	158	151	108	104
MSX2-0193	201	193	191	184	133	127
MSX2-0223	235	226	222	213	153	147
MSX2-0264	280	270	263	254	182	175
MSX2-0372	413	395	373	357	256	245

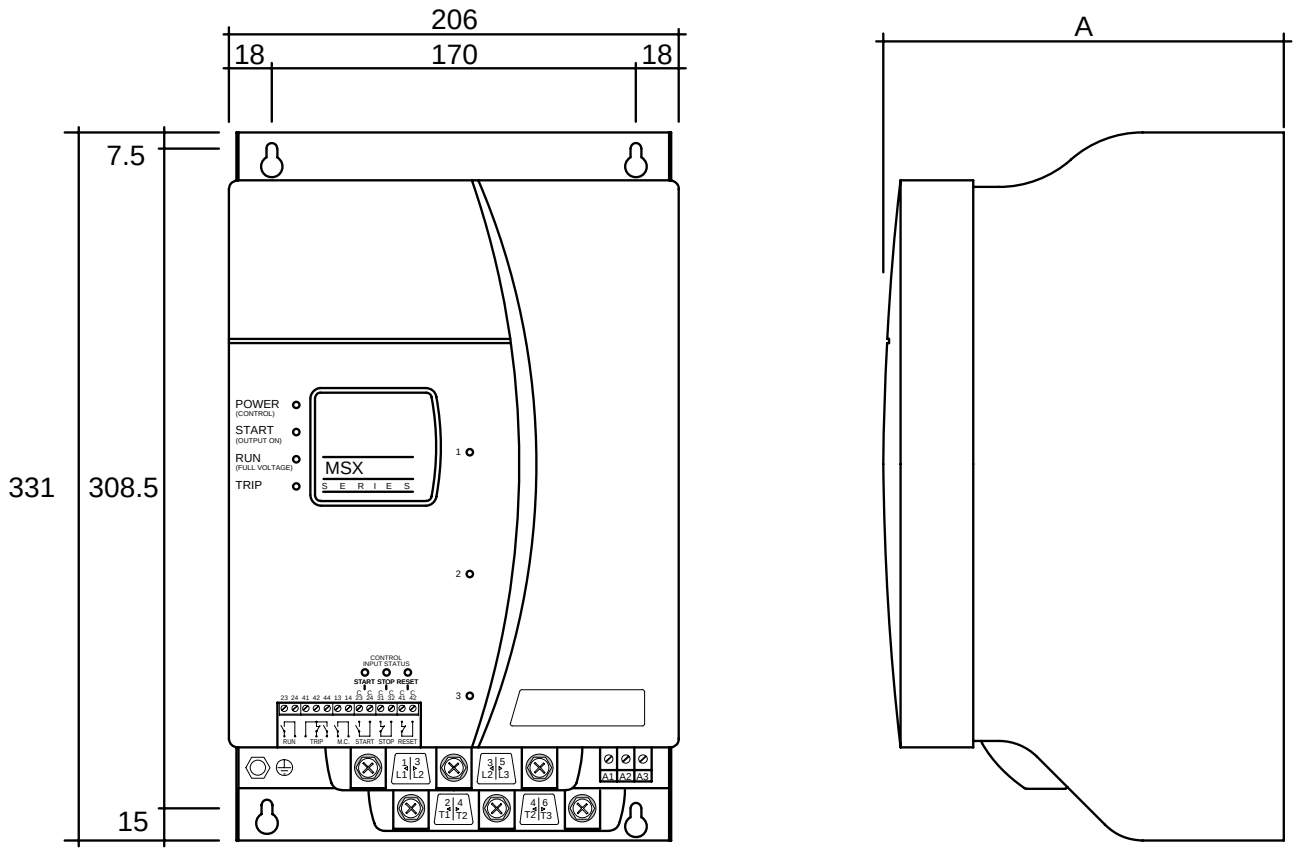
Multilpy by 1.5 for 6 Wire (Inside delta Connection) current rating.

SECTION 5 PHYSICAL SPECIFICATION

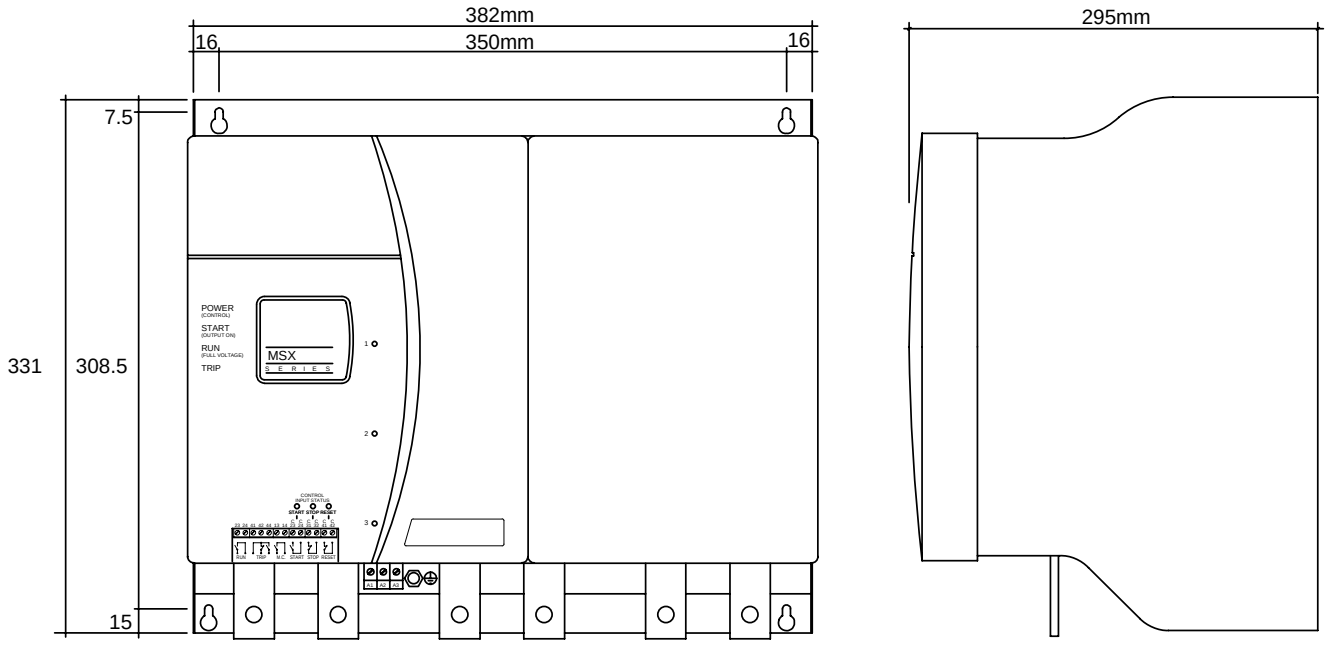
Overview : This section details the mounting and ventilation requirements for the MSX2 Series Starters.

Content :

Dimensions



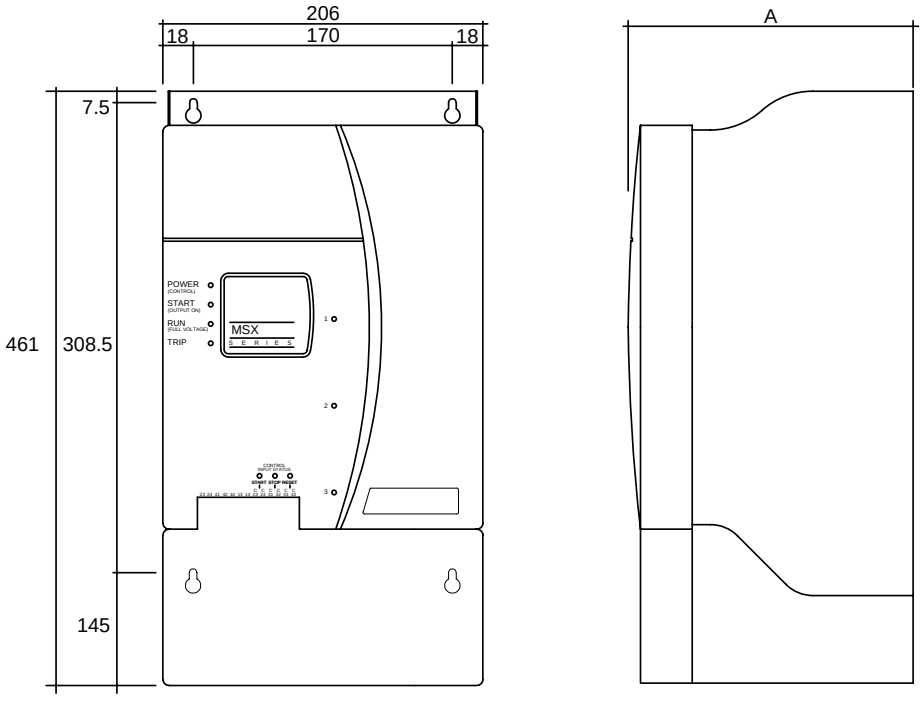
DIMENSION A (mm)	
MSX2-0011, MSX2-0013, MSX2-0025, MSX2-0034, MSX2-0039	180
MSX2-0055, MSX2-0073, MSX2-0080, MSX2-0126, MSX2-0136	250



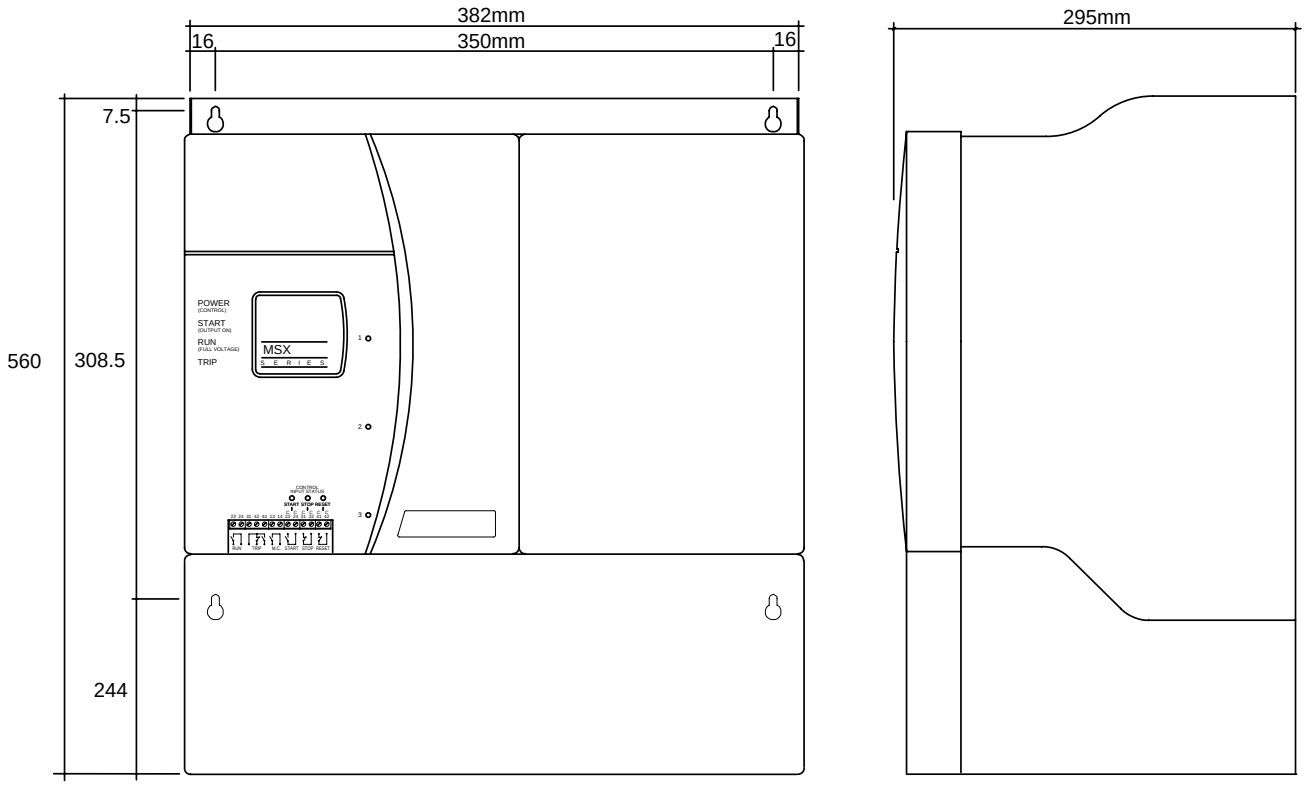
MSX2-0158, MSX2-0193, MSX2-0223, MSX2-0264, MSX2-0372

Wall Mounting The MSX2

The MSX2 can be fitted with an additional Enclosure Extension making the unit IP32 and suitable for wall mounting. The Enclosure Extension is supplied seperately.



	A	Extension Part No.
MSX2-0011, MSX2-0013, MSX2-0025, MSX2-0034, MSX2-0039	180	9FWM1
MSX2-0055, MSX2-0073, MSX2-0080, MSX2-0126, MSX2-0136	250	9FWM2



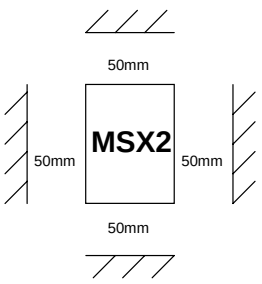
	Extension Part No.
MSX2-0158, MSX2-0193, MSX2-0223, MSX2-0264, MSX2-0372	9FWM3

Weights

MODEL	KG
MSX2-0011	3
MSX2-0013	5
MSX2-0025	5
MSX2-0034	5
MSX2-0039	6
MSX2-0055	9
MSX2-0073	9
MSX2-0080	9
MSX2-0126	10
MSX2-0136	10
MSX2-0158	19
MSX2-0193	19
MSX2-0223	20
MSX2-0264	21
MSX2-0372	21

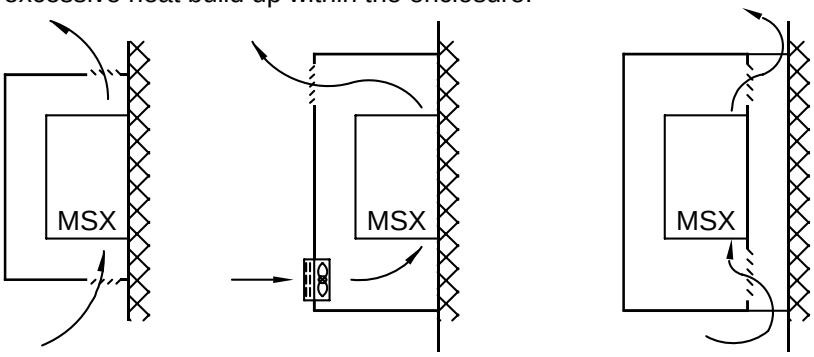
Mounting Precautions

Do not mount in direct sunlight
Do not locate near heat radiating elements
Mount the MSX2 vertically
Allow clearance for ventilation
Do Not Obstruct Cooling Airflow



Mounting In Ventilated Enclosures

When mounting a soft starter, or any other equipment which generates heat, into a vented enclosure there must be sufficient airflow through the enclosure to prevent excessive heat build up within the enclosure.



Soft starters dissipate approximately 4.5 watts per line amp. The following table shows the airflow required to limit internal temperature rise of an enclosure housing a soft starter to +5°C or +10°C.

Where additional heat sources (contactors, cables, isolators etc.) are also housed in the enclosure, airflow will need to be increased accordingly.

MOTOR AMPS	HEAT DISSIPATION (@ 4.5 watts / Amp)	Airflow m^3/minute For:	
		5°C Rise	10°C Rise
10	45	0.5	0.2
20	90	0.9	0.5
30	135	1.4	0.7
40	180	1.8	0.9
50	225	2.3	1.1
75	338	3.4	1.7
100	450	4.5	2.3
125	563	5.6	2.8
150	675	6.8	3.4
175	788	7.9	3.9
200	900	9.0	4.5
250	1125	11.3	5.6
300	1350	13.5	6.8
350	1575	15.8	7.9
400	1800	18.0	9.0
450	2025	20.3	10.1
500	2250	22.5	11.3
550	2475	24.8	12.4
600	2700	27.0	13.5

Mounting In Non-ventilated Enclosures

If the MSX2 is to be mounted in a non-ventilated enclosure a bridging contactor should be employed to eliminate heat build up in the enclosure.

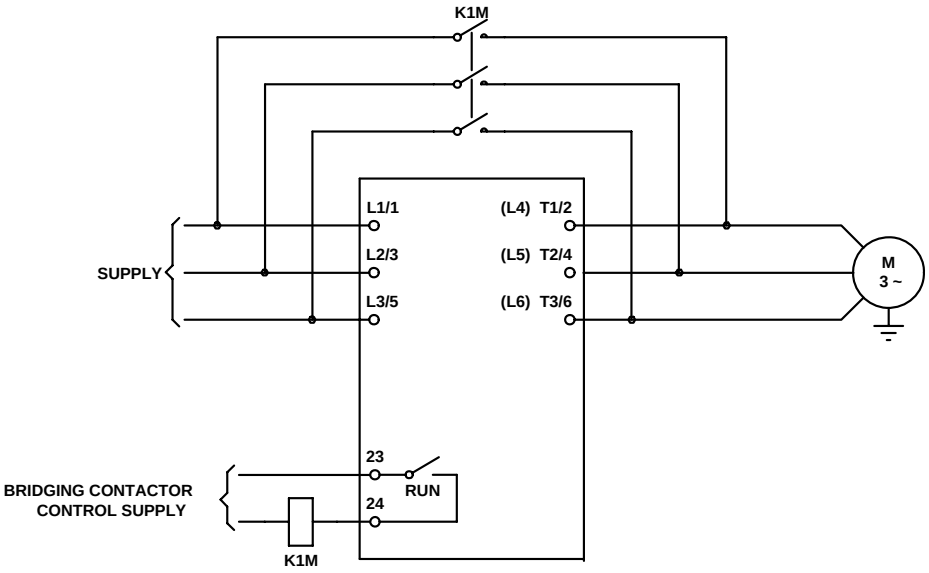
The Bridging contactor can be AC1 rated as it only carries the running current of the motor.

- The bridging contactor should be controlled by the MSX2 Run output (23,24) and used to bridge out the SCRs once the motor has started by bridging between :

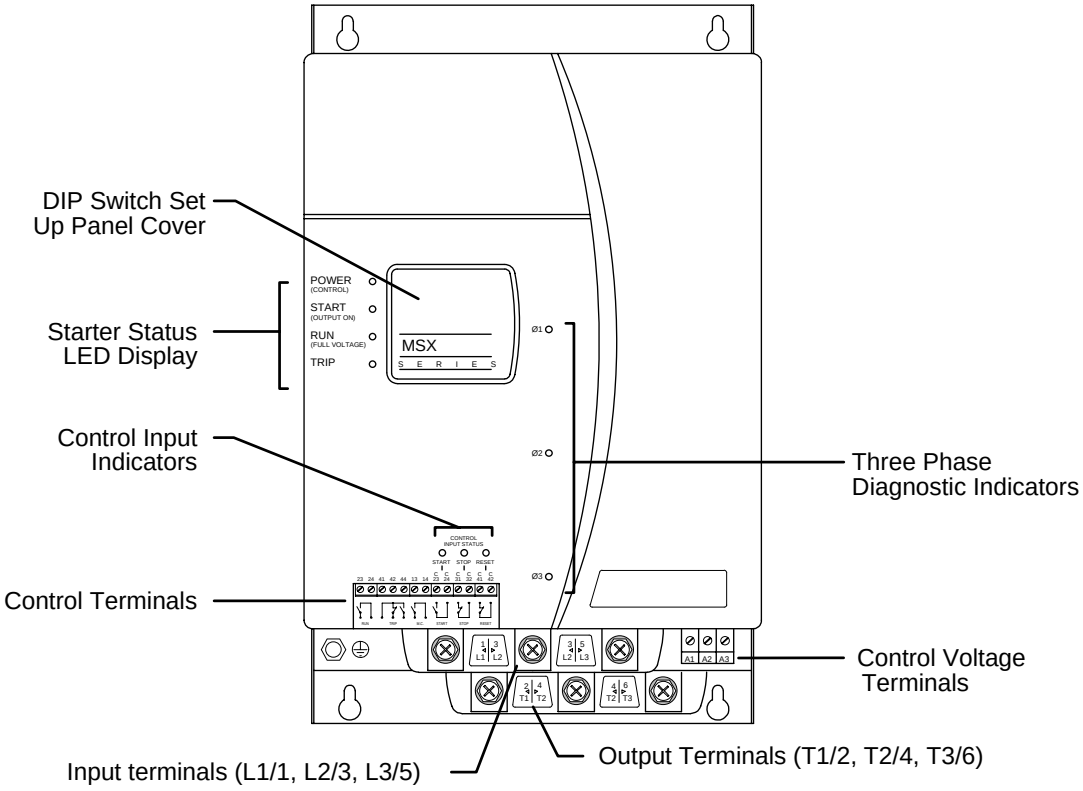
  L1-T1, L2-T2,L3-T3 or

  L1-L4, L2-L5, L3-L6 or

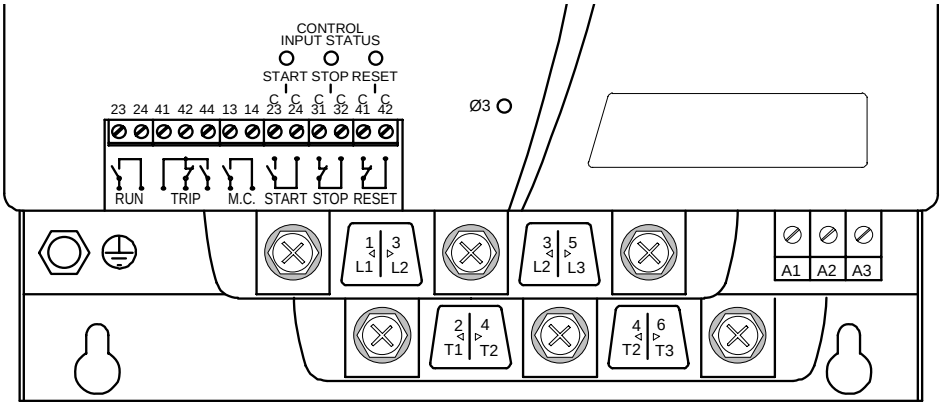
1-2, 3-4, 5-6



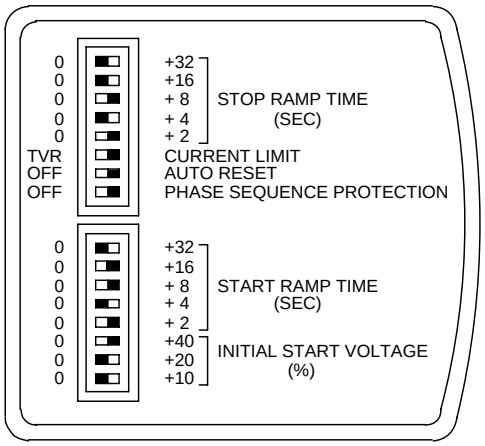
Typical Layout



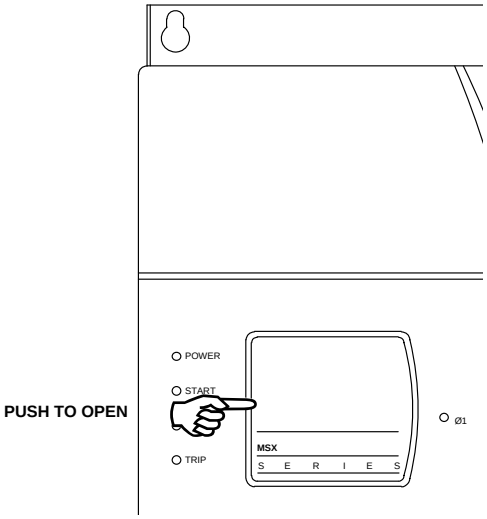
Control Terminations



DIP Switch Set Up Panel



Open access cover over DIP Switch Set Up Panel by pressing where shown.



SECTION 6 ELECTRICAL CONNECTION (POWER CIRCUIT)

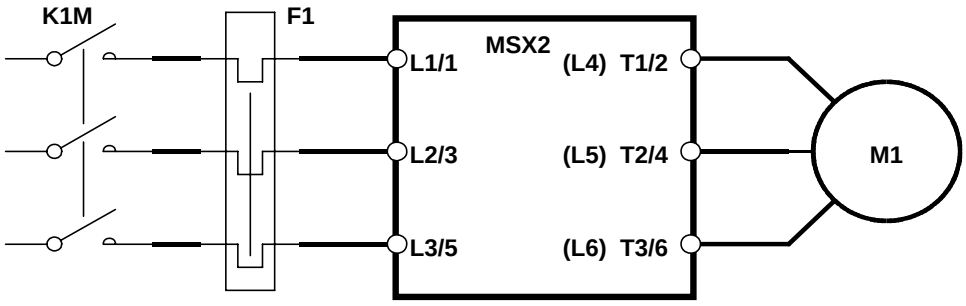
Overview : This section details the various power circuit configurations possible with the MSX2 Series Starters.

Content

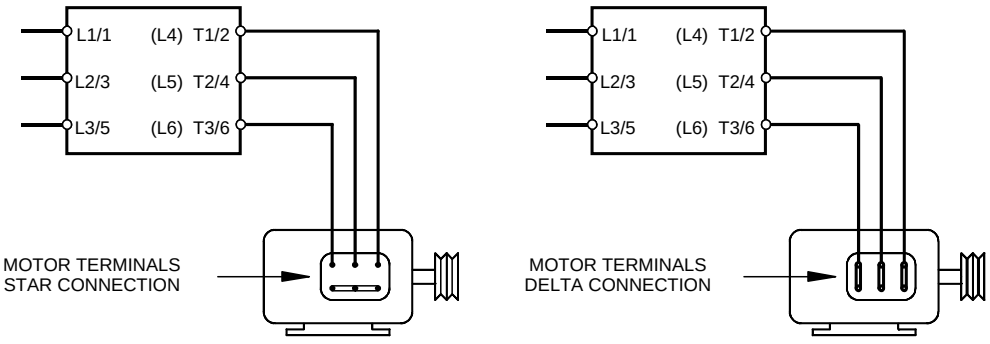
Motor Connection

The MSX2 can be connected to control a variety of different motors in a number of different circuit configurations.

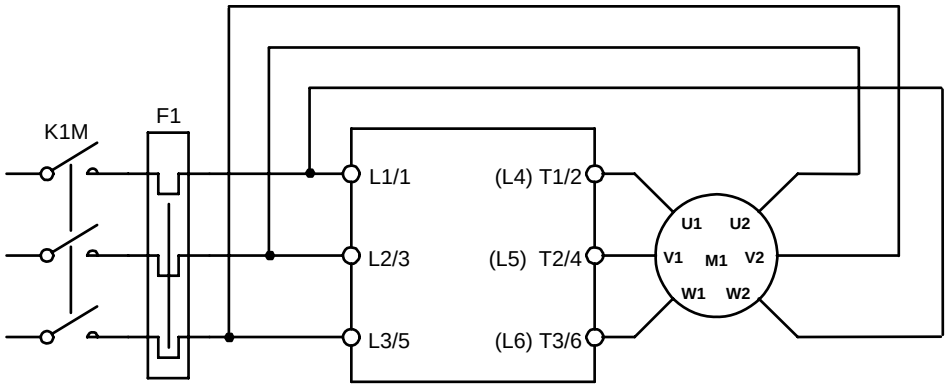
3 Wire Motor Connection



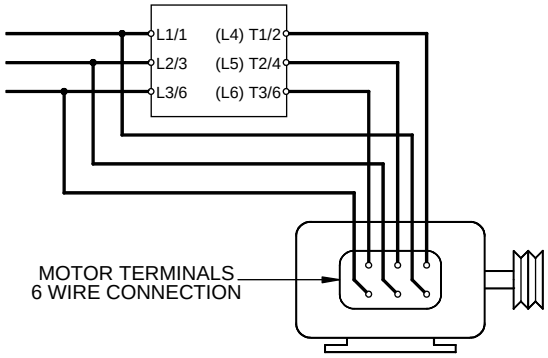
The MSX2 may be connected to motors designed star operation or for motor designed for delta operation, so long as the motor is appropriate for the supply voltage.



6 Wire Motor Connection



Connect the three OUTPUT terminals (T1/2, T2/4, T3/6) of the MSX2 to the motor windings ensuring that the connections are made to one end of each winding only. It is imperative to connect the output of the MSX2 to the same end of each winding and this is usually marked on the motor terminations.



The six terminations to the motor windings are usually arranged in two rows of three so that the links can be fitted across from the top three terminations to the lower terminations. In this case connect the MSX2 to the top terminations only. Connect the other three motor terminals to the input of the MSX2 in a manner that connects the end of each winding to a different phase from the input.

This is easiest achieved by replacing each delta link in the motor terminal box by one phase of the controller.

For example if the delta links are fitted U1-V2,V1-W2,W1-U2

- Connect the incoming phases to L1/1,L2/3,L3/5 on the MSX2.
- Connect the MSX2 to the motor. T1/2-U1, T2/4-V1, T3/6-W1
- Connect the other motor terminals to the MSX2 input. V2-L1/1, W2-L2/3, U2-L3/5

CAUTION

SIX WIRE CONNECTION SHOULD NOT BE MADE WITHOUT USE OF A LINE CONTACTOR AS THE MOTOR REMAINS CONNECTED TO THE SUPPLY EVEN WHEN THE STARTER IS SWITCHED OFF

Line Contactors

The MSX2 is designed to operate with or without a line contactor. In many regions there is a statutory requirement that a line contactor be employed with electronic motor control equipment. From a safety point of view, this is the preferable option, however is not necessary for starter operation.

The MSX2 can directly control a line contactor via the Main Contactor Control output (13,14).

As an alternative to a line contactor, either a circuit breaker with a no volt release coil operated by the MSX2 trip output (41,42,44), or a motor operated circuit breaker can be considered.

If a motor operated circuit breaker is used as a line contactor, the potential delay between the breaker being told to close and phase power being applied to the MSX2 could cause the MSX2 to trip on installation faults. This can be avoided by closing the motorised breaker directly and using the breakers auxiliary contacts to control the MSX2.

Bridging Contactors

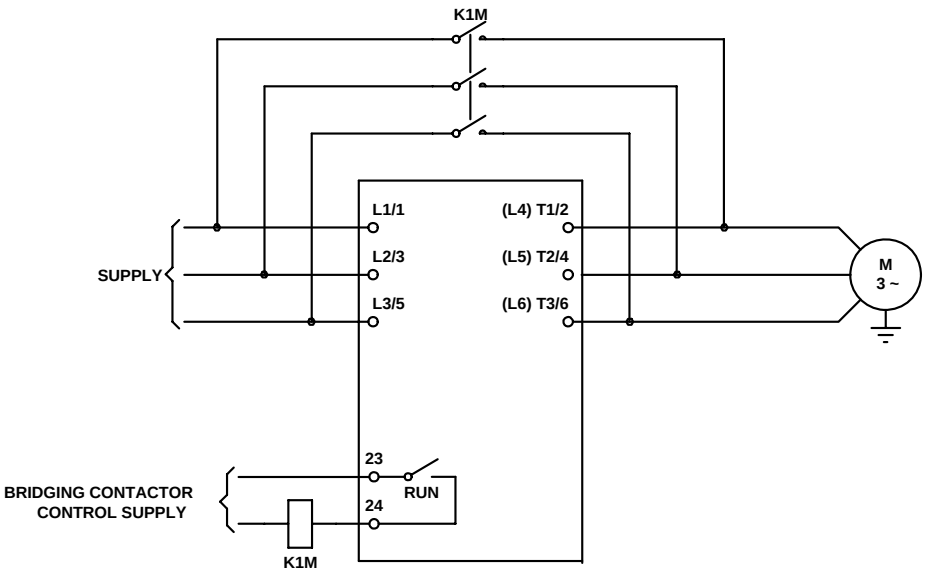
If the MSX2 is to be mounted in a non-ventilated enclosure a bridging contactor should be employed to eliminate heat build up in the enclosure.

Bridging contactor can be AC1 rated as it only carries the running current of the motor.

The bridging contactor should be controlled by the MSX2 Run output (23,24) and used to bridge out the SCRs once the motor has started by bridging between L1/1 - T1/2, L2/3 - T2/4, L3/5 - T3/6.

CAUTION

IT IS IMPERATIVE THAT THE BRIDGING CONTACTOR CONNECTS L1/1 TO T1/2, L2/3 TO T2/4 AND L3/5 TO T3/6. ANY OTHER COMBINATION WILL CAUSE FUSE FAILURE, CIRCUIT BREAKER TRIP AND POSSIBLE SCR FAILURE.



Bridging contactors should be controlled to bridge out the MSX2 during run. The MSX2's bridging contactor control output should be used to control the bridging contactor.

If using a bridging contactor

- Connect between the inputs and outputs of the MSX2 ensuring that with the contactor closed, L1/1 connects to T1/2, L2/3 connects to T2/4 and L3/5 connects to T3/6.

- Connect the coil of the bridging contactor through the MSX2 Run relay outputs to the control voltage.

Power Factor Correction

If static power factor correction is employed, it must be connected to the supply side of the soft starter.

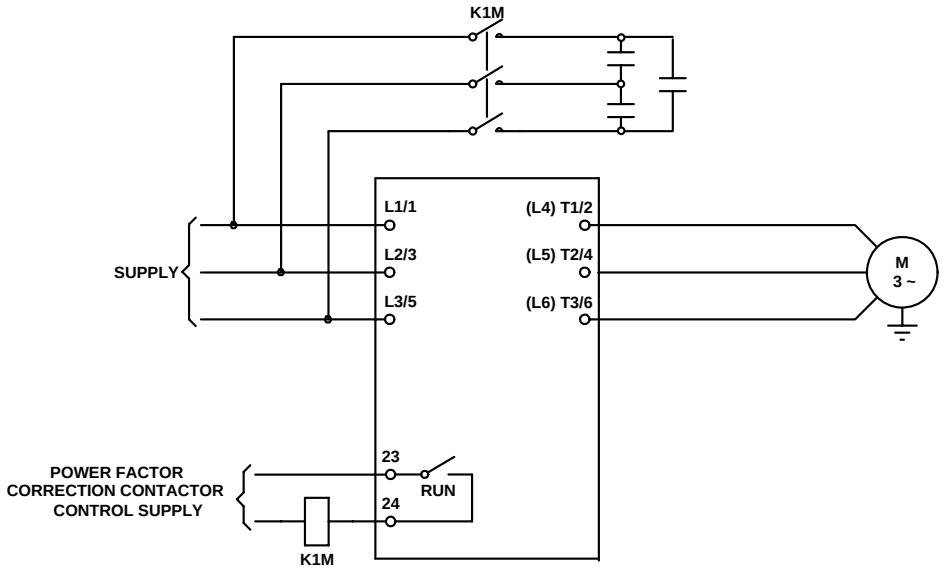
CAUTION

UNDER NO CIRCUMSTANCE SHOULD POWER FACTOR CORRECTION CAPACITORS BE CONNECTED BETWEEN THE SOFT STARTER AND THE MOTOR.

Ideally power factor correction capacitors should be connected to the supply via a dedicated contactor which is energised once the motor has started.

Adding power factor correction capacitance to an inductive supply forms a resonant circuit. This resonant circuit can produce high ringing voltage that can damage the soft starter and other equipment connected to the same supply. Connecting power factor correction capacitors to the supply after the motor has started ensures the supply is loaded and dampens the ringing voltage.

This contactor may be controlled using the MSX2 Run relay (23,24).



Phase Sequence

The supply may be connected to the starter in any phase sequence. However the MSX2 starters Phase Sequence Protection feature may be used to prevent motor rotation in the reverse direction caused by a negative phase sequence.

SECTION 7 ELECTRICAL CONNECTION (CONTROL CIRCUIT)

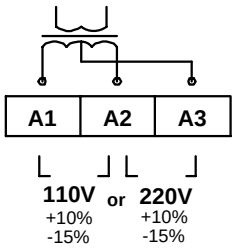
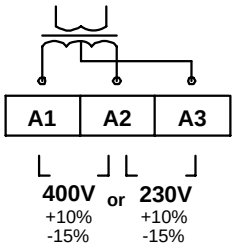
Overview : This section details the connection of control voltage to the MSX2 Starters as well as describing the MSX2's various control inputs and outputs. Additionally, typical connection schematics are provided.

Content :

MSX2 ELECTRONICS & FAN SUPPLY

The MSX2 must be supplied with control voltage which controls both the electronics and cooling fans (if fan cooled). Refer to labeling on the MSX2 for control voltage options.

MSX2 CONTROL VOLTAGE

Canada United States of Amercia	All Other Countries
ELECTRONICS  **110V** +10% -15% **or** **220V** +10% -15%	ELECTRONICS  **400V** +10% -15% **or** **230V** +10% -15%

Control Inputs

The MSX2 incorporates the following control inputs.

Start (C23,C24)

- Active 24 VDC
- Operate with potential free circuit

  Four Wire Control : The start circuit must be closed fleetingly to start the motor. The start signal is latched internally by the MSX2 until either the starter trips or the stop circuit is opened.

  Two Wire Control : In a two wire non latching circuit the start input is linked and the MSX2 is controlled by closing and opening the stop input.
- Contacts used for controlling this input should be low voltage, low current rated. (Gold flash or similar)

Stop (C31,C32)

- Active 24 VDC
- Operate with potential free circuit. (Must be closed for the MSX2 to operate)
- Contacts used for controlling this input should be low voltage, low current rated. (Gold flash or similar)

Reset (C41,C42)

- Active 24 VDC
- Operate with potential free circuit. (Must be closed for the MSX2 to operate). Closed circuit to open circuit transition resets the MSX2
- Contacts used for controlling this input should be low voltage, low current rated. (Gold flash or similar)

Simultaneously opening the STOP & RESET circuits will effect an immediate stop, and cause the trip relay to operate, and then reset after approximately 8 seconds.

Control Input wiring should be run separately from power wiring to prevent noise and possible induced voltage.

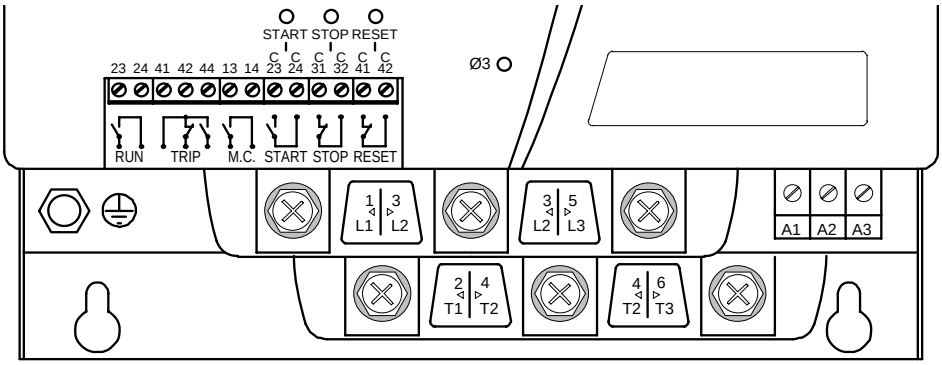
CAUTION

VOLTAGE MUST NOT BE APPLIED TO THE CONTROL INPUT TERMINALS. APPLICATION OF VOLTAGE IS LIKELY TO CAUSE EQUIPMENT DAMAGE.

Operational Overview (Control inputs.)

1) OFF mode.	In the OFF mode, the starter microcomputer monitors the START, STOP, RESET and keypad inputs. a) If the RESET input is open circuit, the MSX2 will ignore all other inputs. b) If the STOP, START and RESET are closed, the starter will enter the PRESTART mode. NB. The START input is only monitored in the OFF mode and SOFT STOP mode.
2) PRESTART mode.	In the PRESTART mode, the main contactor is closed, the starter microcomputer executes a number of measurements, and depending on the results of these, either auto configures itself and enters the START mode, or trips on an installation or phase sequence fault.
3) START mode	In the START mode, the starter microcomputer monitors the STOP and RESET. a) If the STOP is open and the RESET is closed, the starter enters the SOFT STOP mode. b) If both the STOP and the RESET are open, the starter will immediately stop and enter the OFF mode. c) If the output voltage from the starter reaches full voltage, the starter will enter the RUN mode.
4) RUN mode	In the RUN mode, the starter microcomputer monitors the STOP and RESET. a) If the STOP is open and the RESET is closed, the starter enters the SOFT STOP mode. b) If both the STOP and the RESET are open, the starter will immediately stop and enter the OFF mode.
5) SOFT STOP mode	In the SOFT STOP mode, the starter microcomputer monitors the START, STOP and RESET. In SOFT STOP mode, the output voltage is reduced at the rate determined by the stop time parameter. (soft stop) a) If the stop time parameter is zero, the starter immediately enters the OFF mode. b) If both the STOP and the RESET are open, the starter will immediately stop and enter the OFF mode. c) If the START and STOP are closed, the starter enters the START mode. d) As the output voltage approaches zero, the starter enters OFF mode.
6) TRIP mode	In the TRIP mode, the starter microcomputer monitors the RESET input. In TRIP mode, SCR conduction is inhibited. a) If the RESET is closed, the starter enters the OFF mode.

Control Outputs The MSX2 incorporates the following control outputs



Run (23,24)

- Potential Free, Normally Open Relay Contact
- Closes when MSX2 is applying full line voltage to the motor.
- Designed to control a bridging contactor, if fitted, and/or as an Off-Load control output for compressors, conveyors, pumps etc.

Trip (41,42,44)

- Potential Free, Changeover Relay Contacts
- Changes state when the MSX2 is in the tripped state.

Main Contactor (13,14)

- Potential Free, Normally Open Relay Contact
- Closes when the MSX2 receives start signal, opens when MSX2 stops applying voltage to the motor and when the MSX2 Trips
- Designed to control operation of a line contactor if fitted to the input of the MSX2. This function is particularly useful when utilising the Soft Stop function and a line contactor, as it closes the contactor on start and opens the contactor at the end of the ramp down period.

Starter Operation (Relay outputs.)

1) OFF mode.	In the OFF mode, the Main Contactor, Start/Run and Run relay outputs are in their normally open state and the trip relay is in the normal state also.
2) PRESTART mode.	In the PRESTART mode, the main contactor is closed, the starter microcomputer executes a number of measurements, and depending on the results of these, either auto configures itself and enters the START mode, or trips on an installation or phase sequence fault.
3) START mode	In START mode, the Main Contactor relay is closed. a) If the output voltage from the starter reaches full voltage, the starter will enter the RUN mode.
4) RUN mode	In RUN mode, the Main Contactor relay is closed, and the Run relay is closed.
5) SOFT STOP mode	In SOFT STOP mode, the Run relay is open. The Main Contactor relay is closed. The output voltage is reduced at the rate determined by the stop time parameter. (soft stop) a) If the stop time is zero, the starter immediately enters the OFF mode. b) As the output voltage approaches zero, the starter enters OFF mode.
6) TRIP mode	In TRIP mode, the Main Contactor and Run relays are open and the Trip relay changes state. SCR conduction is inhibited. a) If the RESET is closed, the starter enters the OFF mode.

Typical Installation Formats

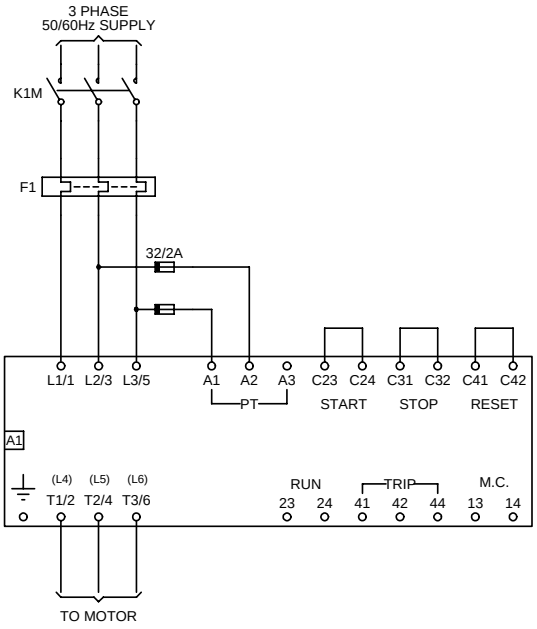
The MSX2 Series starters may be connected and controlled in a wide variety of ways. Five common application formats are detailed in the following application examples.

If none of these options fully meets application requirements further study of this Users Manual should enable custom design of an appropriate circuit.

APPLICATION 1: A typical application where the MSX2 has been installed between a DOL starter and the motor. (Not suitable for applications requiring soft stop).

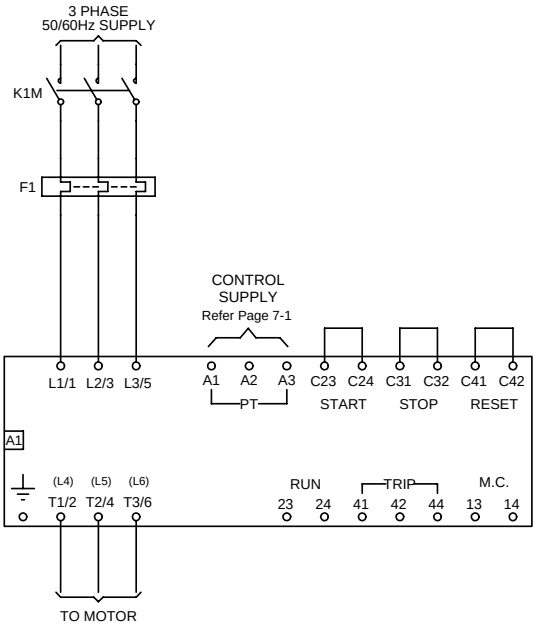
Line Feed Control Voltage

MSX2 control voltage may be sourced directly from the incoming supply where the supply voltage is compatible with one or other of the MSX2 control voltage inputs. Refer Control Voltage options marked on the unit or refer page 7-1 of this manual.



Independently Feed Control Voltage

MSX2 control voltage may be supplied from an independent supply. Refer Control Voltage options marked on the unit. or refer page 7-1 of this manual.



LEGEND	
A1	MSX SOFT STARTER
F1	THERMAL OVERLOAD
K1M	LINE CONTACTOR

INSTALLATION PROCEDURE

1. Install the soft starter between the DOL starter and the motor, by connecting the output of the DOL starter to the soft starter Input terminals (L1/1, L2/3 & L3/5), and connecting the motor to the soft starter output terminals (T1/2, T2/4, T3/6).
2. Connect control voltage to the soft starter Power Transformer (Terminals A1 & A2).
3. Ensure a link is installed across the soft starter's Start Terminals located on the Main Control PCB.
4. Starter performance may be adjusted using the DIP SWITCH panel on the Main Control PCB. Refer to the Initial Set Up Procedure section of this manual for adjustment procedure.

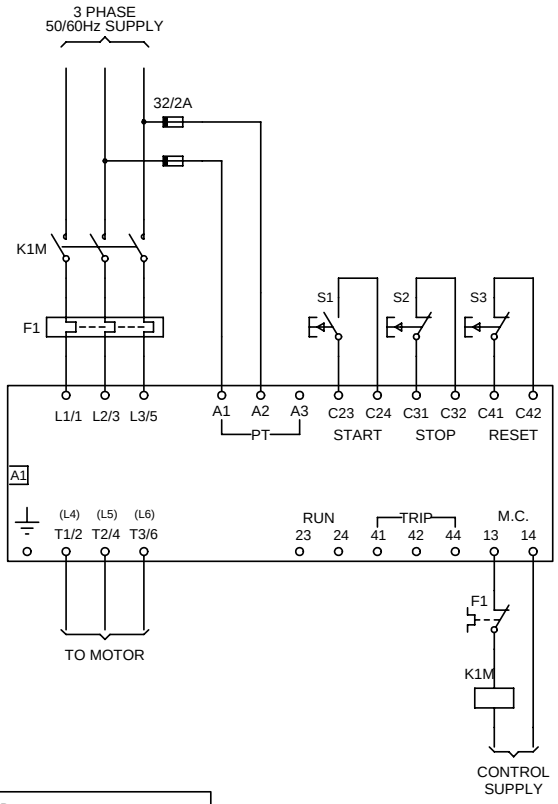
NOTES

1. Initiating a start closes the line contactor and applies power to the soft starter, allowing it to soft start the motor. Initiating a stop removes power from the soft starter and stops the motor.
2. Soft stop is not available in this configuration. Refer to application circuits 2, 3 & 5 if soft stop required.
3. Trip states may be reset, and fault indication cleared by :
   - Removal of control voltage from the soft starter.
   - Operating the soft starter's reset circuit.
   - The Auto-Reset function.

APPLICATIONS 2 A typical application where the MSX2, controlled directly via a four wire Start/Stop circuit, is used to control line contactor (K1M) operation. (This circuit is appropriate for applications requiring Soft Stop)

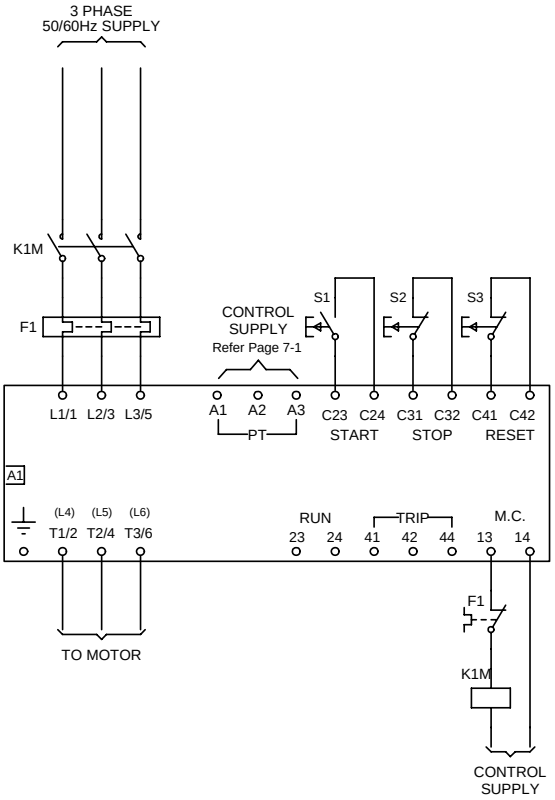
Line Feed Control Voltage

MSX2 control voltage may be sourced directly from the incoming supply where the supply voltage is compatible with one or other of the MSX2 control voltage inputs. Refer Control Voltage options marked on the unit or refer page 7-1 of this manual.
In this configuration, voltage must be sourced on the line side of the contactor.



Independently Feed Control Voltage

MSX2 control voltage may be supplied from an independent supply. Refer Control Voltage options marked on the unit. or refer page 7-1 of this manual.
In this configuration, voltage must be sourced on the line side of the contactor.



LEGEND	
A1	MSX SOFT STARTER
F1	THERMAL OVERLOAD RELAY
K1M	LINE CONTACTOR
S1	START PUSHBUTTON
S2	STOP PUSHBUTTON
S3	RESET PUSHBUTTON

INSTALLATION PROCEDURE

1. Connect line voltage to the soft starter Input terminals (L1/1, L2/3 & L3/5), via an appropriate line contactor and motor protection device. Connect the motor to the soft starter output terminals (T1/2, T2/4, T3/6).
2. Connect control voltage to the soft starter Power Transformer (Terminals A1 & A2).
3. Connect control circuitry as shown.
4. Starter performance may be adjusted using the DIP SWITCH panel on the Main Control PCB. Refer to the Initial Set Up Procedure section of this manual for adjustment procedure.

NOTES

1. Operating the start button initiates a start by causing the soft starter to close the line contactor and apply power to the motor.
2. Operating the stop button causes the soft starter to stop/soft stop the motor. On completion of the stop ramp time the soft starter opens the line contactor.
3. Trip states may be reset, and fault indication cleared by :
   - Removal of control voltage from the soft starter.
   - Operating the reset circuit.
   - The Auto-Reset function.

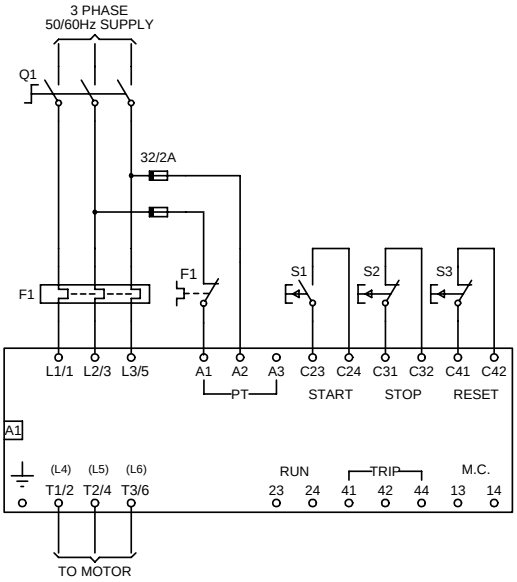
APPLICATIONS 3 A typical application where the MSX2 is applied without a line contactor, and is controlled direct by four wire start/stop circuit. (This circuit is appropriate for applications requiring Soft Stop)

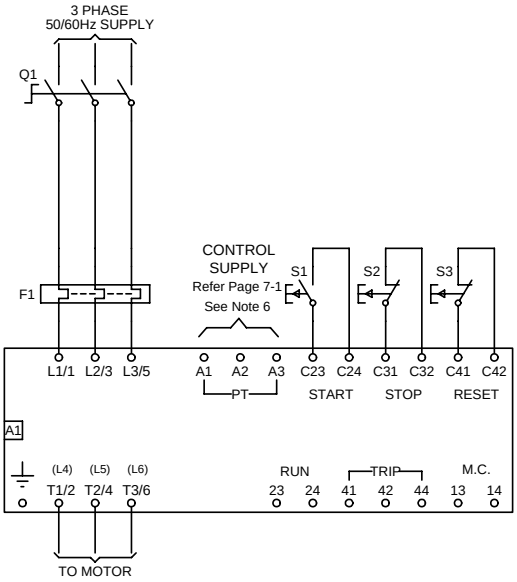
Line Feed Control Voltage

MSX2 control voltage may be sourced directly from the incoming supply where the supply voltage is compatible with one or other of the MSX2 control voltage inputs. Refer Control Voltage options marked on the unit or refer page 7-1 of this manual.
In this configuration, voltage must be sourced on the line side of the contactor.

Independently Feed Control Voltage

MSX2 control voltage may be supplied from an independent supply. Refer Control Voltage options marked on the unit. or refer page 7-1 of this manual.
In this configuration, voltage must be sourced on the line side of the contactor.





LEGEND	
A1	MSX SOFT STARTER
F1	THERMAL OVERLOAD
S1	START PUSBUTTON
S2	STOP PUSHBUTTON
S3	RESET PUSHBUTTON
Q1	LINE ISOLATOR

INSTALLATION PROCEDURE

1. Connect line voltage to the soft starter Input terminals (L1/1, L2/3 & L3/5), via an appropriate motor protection device. Connect the motor to the soft starter output terminals (T1/2, T2/4, T3/6).
2. Connect control voltage to the soft starter Power Transformer (Terminals A1 & A2).
3. Connect control circuitry as shown.
4. Starter performance may be adjusted using the DIP SWITCH panel on the Main Control PCB. Refer to the Initial Set Up Procedure section of this manual for adjustment procedure.

NOTES

1. Operating the start button initiates a start by causing the soft starter to apply power to the motor.
2. Pushing the stop button causes the soft starter to stop/soft stop the motor.
3. Operation without a contactor is allowed in some countries. Ensure that local regulations permit operation without a contactor before using this circuit.
4. Use only three wire motor connection when applying the soft starter without a line contactor.
5. Trip states may be reset, and fault indication cleared by :
   - Removal of control voltage from the soft starter.
   - Operating the reset circuit.
   - The Auto-Reset function.
6. The motor protection trip contact must be used to interrupt control voltage to the MSX2 in the event of an overcurrent trip.

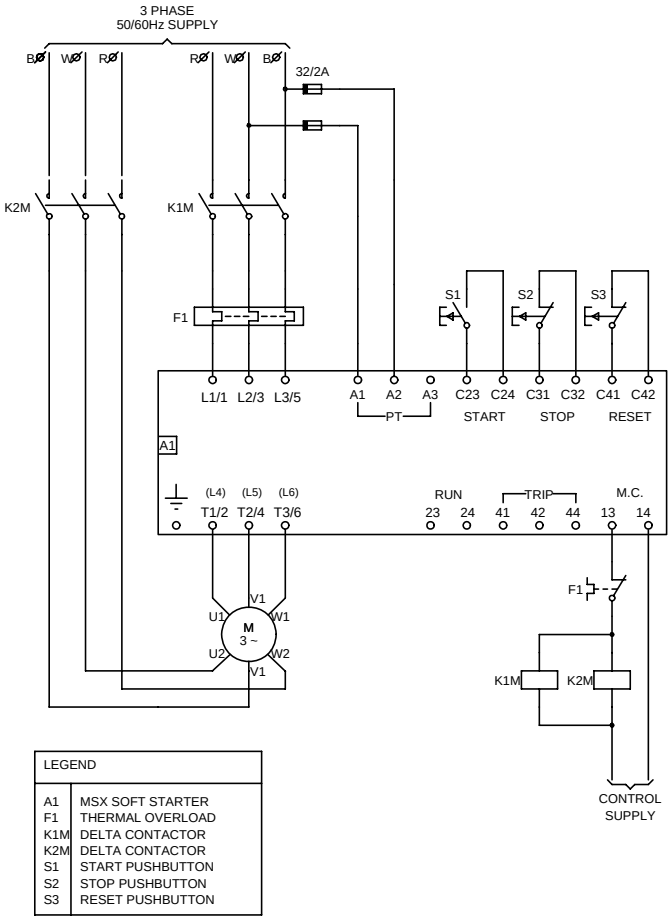
APPLICATION 4 A typical application where an existing Star/Delta starter installation is modified for soft start.

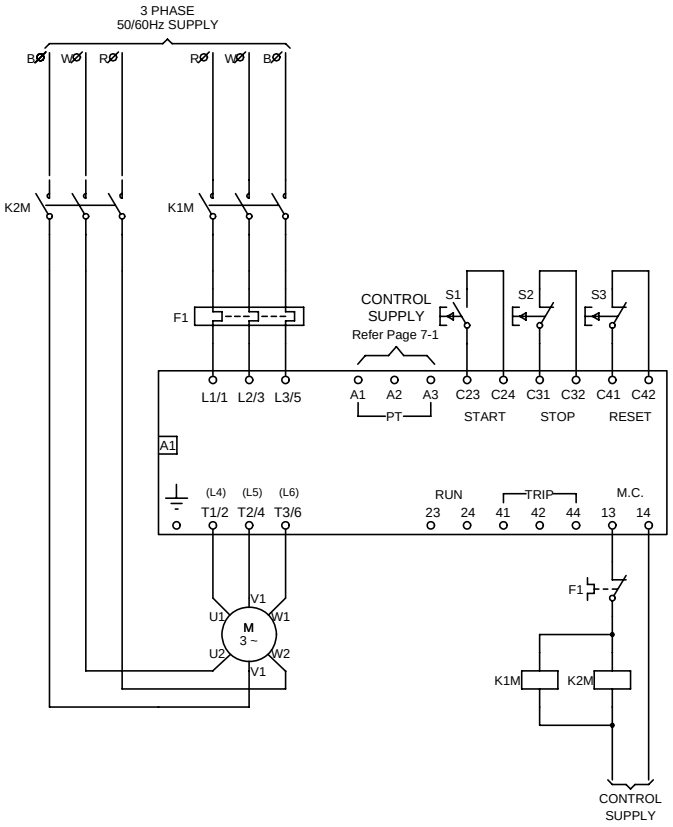
Line Feed Control Voltage

MSX2 control voltage may be sourced directly from the incoming supply where the supply voltage is compatible with one or other of the MSX2 control voltage inputs. Refer Control Voltage options marked on the unit or refer page 7-1 of this manual.
In this configuration, voltage must be sourced on the line side of the contactor.

Independently Feed Control Voltage

MSX2 control voltage may be supplied from an independent supply. Refer Control Voltage options marked on the unit. or refer page 7-1 of this manual.
In this configuration, voltage must be sourced on the line side of the contactor.





LEGEND	
A1	MSX SOFT STARTER
F1	THERMAL OVERLOAD
K1M	DELTA CONTACTOR
K2M	DELTA CONTACTOR
S1	START PUSHBUTTON
S2	STOP PUSHBUTTON
S3	RESET PUSHBUTTON

INSTALLATION PROCEDURE

1. Disconnect and remove the star contactor from the Star/Delta starter.
2. Install the soft starter between the thermal overload and motor as shown below.
3. Connect control voltage to the soft starter Power Transformer (Terminals 1 & 2).
4. Configure control circuitry as shown.
5. Starter performance may be adjusted using the DIP SWITCH panel on the Main Control PCB. Refer to the Initial Set Up Procedure section of this manual for adjustment procedure.

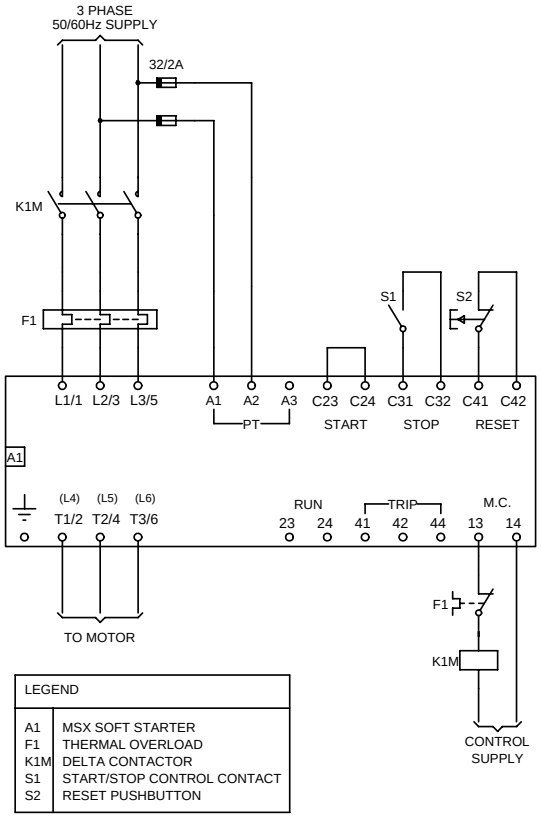
NOTES

- Initiating a start closes the contactors and applies power to the MSX2, allowing it to soft start the motor. Initiating a stop removes power from the soft starter and stops the motor.
- Soft stop is not operative in this configuration because power is removed from the starter when a stop is called for. Refer to application circuits 2, 3 & 5 if soft stop required.
- Trip states may be reset, and fault indication cleared, by operating the reset pushbutton.
- This connection method sees the MSX2 connected in 6 Wire configuration using existing contactors. 6 Wire connection may also be impliemented using a single appropriately rated line contactor.

APPLICATIONS 5 A typical application where the MSX2, controlled directly via an automatic two wire potential free contact, is used to control line contactor (K1M) operation. This circuit is appropriate for applications requiring Soft Stop.

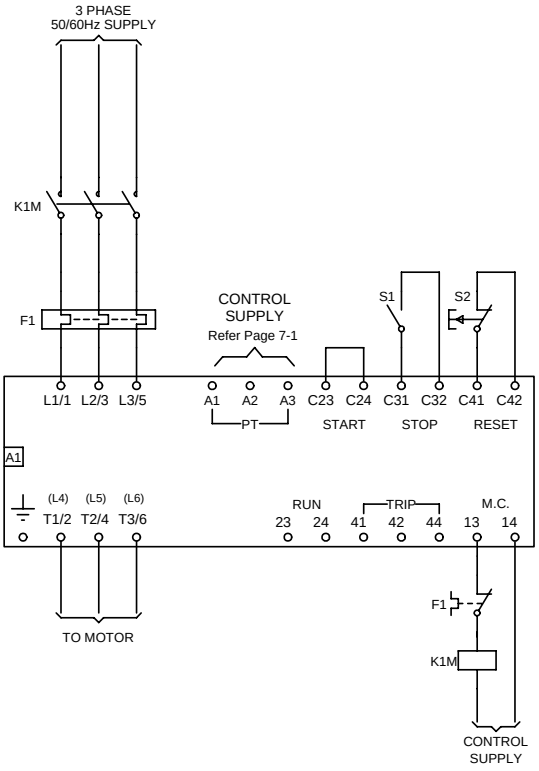
Line Feed Control Voltage

MSX2 control voltage may be sourced directly from the incoming supply where the supply voltage is compatible with one or other of the MSX2 control voltage inputs. Refer Control Voltage options marked on the unit or refer page 7-1 of this manual.
In this configuration, voltage must be sourced on the line side of the contactor.



Independently Feed Control Voltage

MSX2 control voltage may be supplied from an independent supply. Refer Control Voltage options marked on the unit. or refer page 7-1 of this manual.
In this configuration, voltage must be sourced on the line side of the contactor.



INSTALLATION PROCEDURE

1. Connect line voltage to the soft starter input terminals (L1/1, L2/3 & L3/5), via an appropriate line contactor and motor protection device. Connect the motor to the soft starter output terminals (T1/2, T2/4, T3/6).
2. Connect control voltage to the soft starter Power Transformer (Terminals 1 & 2).
3. Connect control circuitry as shown.
4. Starter performance may be adjusted using the DIP SWITCH panel on the Main Control PCB. Refer to the Initial Set Procedure section of this manual for adjustment procedure.

NOTES

1. Closing the STOP input causes the soft starter to close the line contactor and apply power to the motor.
2. Opening the STOP input causes the soft starter to stop/soft stop the motor. On completion of the stop ramp time the soft starter opens the line contactor.
3. Trip states may be reset, and fault indication cleared by :
   - Removal of control voltage from the soft starter.
   - Operating the reset circuit.
   - The Auto-Reset function.

SECTION 8 COMMISSIONING PROCEDURE

Overview : This section details commissioning procedures for an MSX2 installation.

Content :

PRE-COMMISSIONING CHECKS

STEP	CHECK
1	Ensure that the correct model has been supplied as ordered for the application.
2	Inspect the starter and report any visible signs of damage to the unit.
3	Verify that the control circuit is a) suitable for the application b) compatible with the MSX2 control philosophy.
4	Cooling of the MSX2 is important for the long term reliability of the. Ensure that the ventilation is appropriate for the application and that the MSX2 cooling fans are not obstructed. If the MSX2 is not bypassed during run, ensure that there is provision for sufficient passage of air out of the enclosure to cool the unit. This may require forced ventilation of the enclosure.
5	Check that the Electronics PT input is connected to a control supply, using either terminals A1 and A2, or A2 and A3. NB ONLY TWO TERMINALS ARE TO BE CONNECTED!
6	Following the starter adjustment procedures, detailed in section 9 of this manual, set the starter for the desired starting parameters.

COMMISSIONING PROCEDURE

STEP	CHECK
1	Ensure the enclosure is free of metallic swarf and wire offcuts.
2	Before connecting the output terminals to the motor, carry out an insulation test of the motor windings to earth. The reading should be in excess of 10 Megohms. If practical, an insulation test between windings should also be carried out.
3	Connect the output terminals to the motor.
4	Ensure that all the main power terminations are tight.
5	Ensure that the voltage applied to the isolator is correct and that all three phases are present.
6	Apply power to the Electronics PT input, and ensure that the POWER LED on the control panel illuminates.
7	Ensure that the incoming supply is connected to L1/1, L2/3 and L3/5.
8	If the MSX2 is installed with a bypass contactor, ensure that the contactor is bypassing the appropriate terminals on the MSX2. L1/1 must connect via the bypass contactor to T1/2, L2/3 must connect via the contactor to T2/4, and L3/5 must connect via the contactor to T3/6. If the MSX2 is incorrectly bypassed, damage to the starter can result.
9	Ensure that the START input to the MSX2 is open circuit. This will ensure that the MSX2 can not start while other test are carried out.
10	Ensure that all fans are running freely (fan cooled units only) and the POWER LED is illuminated.
11	Check the status of all the control inputs by measuring the voltage across them. The STOP and RESET should show zero volts if closed. If two wire control is employed, then the STOP input should be open and have a terminal voltage of between 12 and 24 VDC.
12	Connect an ammeter in the circuit to display the current during start. A sufficiently rated Clamp type meter would be satisfactory.
13	Ensure that the motor, couplings and machine are ready for an attempted start.
14	Start the motor using the MSX2 and monitor the start current and the direction of rotation. If the direction of rotation is incorrect, stop the machine, isolate the starter and : 3 Wire Installations - swap two phases on the input or the output of the starter. 6 Wire Installations - reconfigure the wiring to the starter and motor.
15	Ensure the measured start current does not exceed the ratings of the MSX2.
16	If a Bypass contactor is employed, ensure that it closes once the motor has reached full speed and the start current has fallen.
17	Ensure that the motor and machine operate satisfactorily.

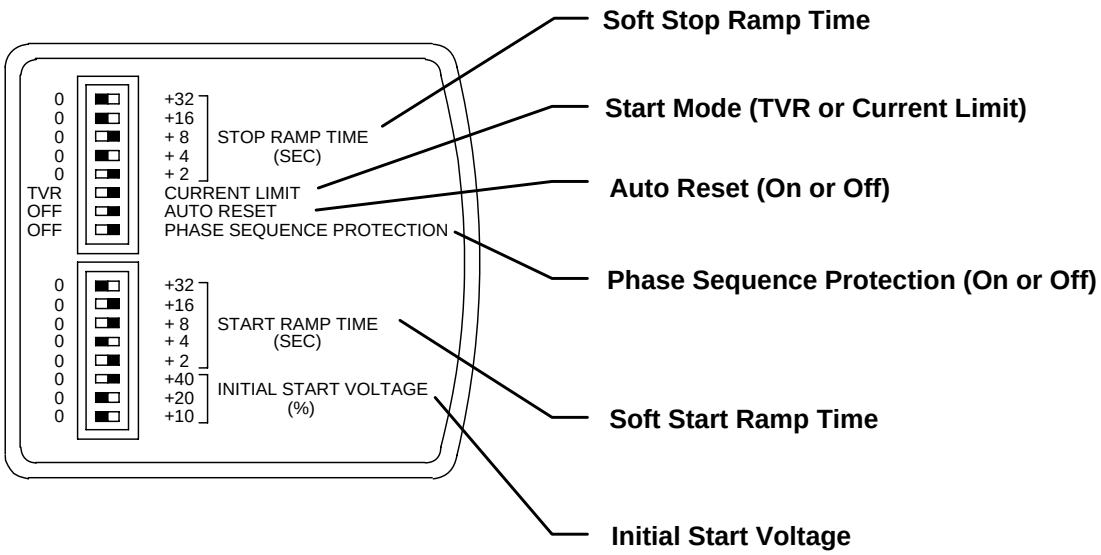
SECTION 9 MSX2 PROGRAMMING PROCEDURE

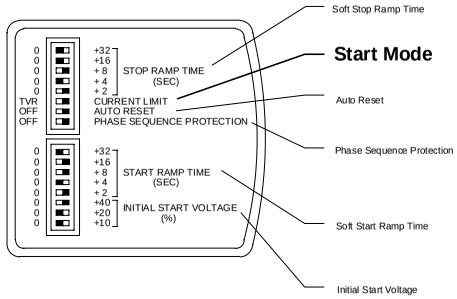
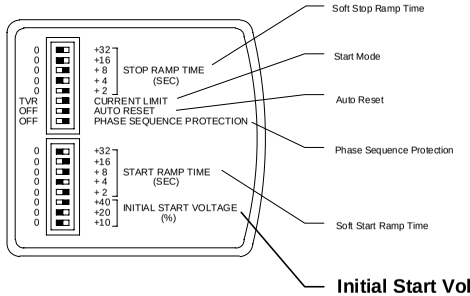
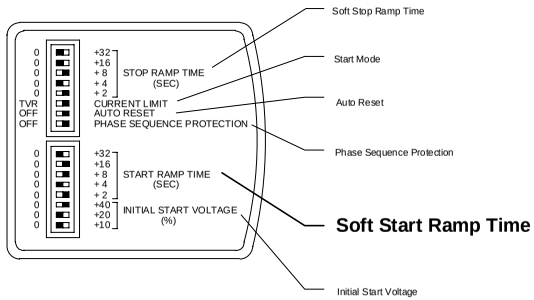
Overview : This section provides instruction adjustment of MSX2 start parameters.

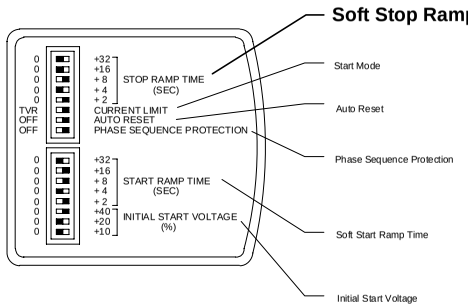
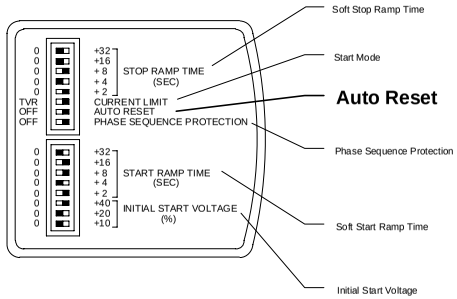
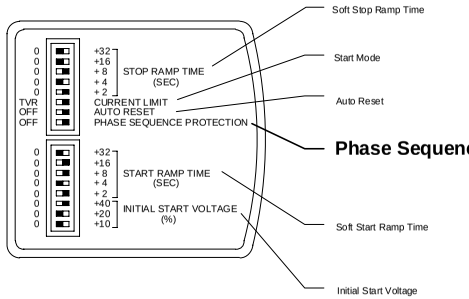
Content :

Overview of MSX2 Adjustment

The MSX2 is adjusted via a digital DIP Switch adjustment panel. The following adjustments may be made :



FUNCTION	PURPOSE	SETTING INSTRUCTIONS
	To select the desired start mode.	Select TVR start mode for low inertia loads such as pumps. Select Current Limit start mode for high inertia loads.
	To set the level Start Voltage applied to the motor at commencement of a start.	Set the three (3) Initial Start Voltage switches to add up to the required start voltage. The start voltage should be set high enough to provide breakaway torque for the load. i.e. adjust the Initial Start Voltage setting so that the motor immediately begins to rotate when a start is called for.
	To set the Start Ramp Time thereby regulating the start current and acceleration time.	Set the five (5) Start Ramp Time switches to add up to the required start ramp time. Monitor start current during commissioning and ensure the selected ramp time does not cause the measured start current to exceed the MSX2 start current rating. Use a long time for high inertia loads and a short time for low inertia loads. The time set does not dictate actual start time as this is dependent on the motor and load characteristics. The start ramp time does however influence the acceleration rate of the motor and should be determined by experimentation.

	To set the Stop Ramp Time if a Soft Stop is required.	Set the five (5) Stop Ramp Time switches to add up to the required stop ramp time. Set all switches off to defeat the Soft Stop function. The Stop Ramp Time setting should be adjusted to optimise stopping performance for the connected load. The time set does not dictate actual stopping time as this is dependent on the motor and load characteristics. The stop ramp time does however influence the deceleration rate of the motor and should be determined by experimentation.
	To activate the Auto Reset function if required.	Set the Auto Reset switch to activate or defeat the Auto Reset Function. Activate the Auto Reset function to prevent lockout trips and enable a restart attempt if a trip occurs. The MSX2 will only attempt a restart if the start signal is still present. Before configuring the circuit for an Automatic Restart, ensure such operation meets all relevant safety regulations or considerations.
	To activate the Phase Sequence Protection function if required.	Set the Phase Sequence Protection switch to activate or defeat the Phase Sequence Protection Function. Activate the Phase Sequence Protection function to prevent reverse motor rotation due to changes in the phase sequence of the incoming supply. Defeat the Phase Sequence protection function if reversing contactors are employed.

SECTION 10 TROUBLE SHOOTING GUIDE

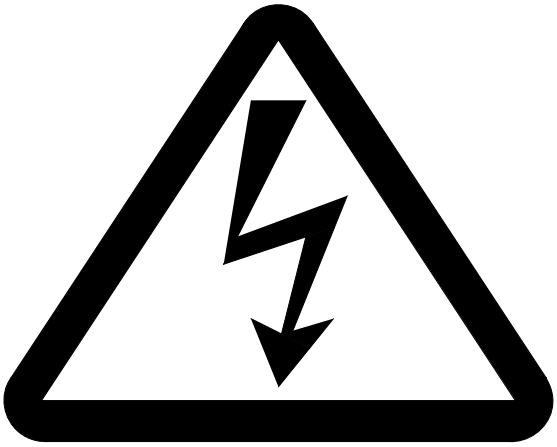
Overview : This section details the MSX2 diagnostic displays and provides assistance in identifying system faults.

Content :

READ MANUAL COMPLETELY PRIOR TO CONNECTING AND COMMISSIONING THIS EQUIPMENT

Fault finding and/or repair of this equipment must be undertaken only by suitably qualified personnel.

WARNING



ELECTRICAL SHOCK HAZARD

ENSURE THE MSX2 IS COMPLETELY ISOLATED FROM THE POWER SUPPLY BEFORE ATTEMPTING ANY WORK ON THE UNIT

SYMPTOM	POSSIBLE CAUSE	ACTION / TEST
Starter Trips - Three Phase Indicator LEDs NOT all illuminated or NOT glowing with equal brilliance.	Invalid Motor Connection	With voltage supplied to the input of the MSX2, check the voltage, input to output, of each phase of the MSX2. If the voltage measured on the phase which has the dim or extinguished LED is zero, low or not equal to the other phases, this indicates the potential for an incorrect motor connection. Verify the motor connection format referring to Section 6 of this manual.
	Missing Phase(s)	With voltage supplied to the input of the MSX2, check the voltage, input to output, of each phase of the MSX2. If the voltage measured on the phase which has the dim or extinguished LED is zero, low or not equal to the other phases, this indicates the potential for an electrical supply problem. Ensure three phases are present at the MSX2 input terminals. Ensure that the motor is correctly connected to the starter in a valid format. Ensure that each winding of the motor is continuous. Verify each circuit between the starter and motor.
	Failed SCR	With voltage supplied to the input of the MSX2, check the voltage, input to output, of each phase of the MSX2. If the voltage measured on the phase which has the dim or extinguished LED is zero, low or not equal to the other phases, this indicates potential for a failed SCR. Disconnect all connections to the MSX2 input and output terminals. Measure the insulation resistance of each phase in both directions with a 500V tester. The measured resistance should be approximately 33 Kohms. If the resistance is significantly less than 33Kohms, the SCR is likely to have failed. If the resistance is significantly higher than 33Kohms, the control PCB is likely to have failed.
Starter Trips - Three Phase Indicator LEDs all glow with equal brilliance	Invalid Phase Sequence	If not required, ensure the MSX2's phase sequence protection is switched off and retry. It may be necessary to reverse the incoming phase sequence if phase sequence protection is required.
	Frequency Out Of Range	Check the supply frequency. Refer specification section of this manual.
Power LED Does Not Illuminate	Incorrect Control Voltage	Ensure that the control voltage is present and correctly connected to the transformer inputs (A1& A2 **or** A2 & A3). This can be easily checked using an A.C.volt meter and measuring the voltages at the terminals. Voltages should correspond to those listed on the MSX2 nameplate.
	Control Fuse Failure	Ensure that all fuses in the control and power circuits are intact.

SYMPTOM	POSSIBLE CAUSE	ACTION / TEST
Power LED Does Not Illuminate (cont.)	Transformer Failure	The integrity of the MSX2 PT can be checked by measuring the secondary voltage of the transformer. Remove the MSX2 cover to reveal the PT and unplug the white plug from the Main Control PCB. After confirming the correct voltage is applied to the input of the transformer, measure the AC voltage coming from the transformer. This should be 18VAC (±4V) between the two orange leads, and 9VAC (±2V) between the purple lead and each of the orange leads.
Motor Will Not Start	Control Circuit Fault	Check the Control Input Indicators above each of the control inputs and ensure they indicate the expected circuit status. The Stop and Reset circuits must be closed before the unit will accept a start input. Status of the control inputs can be independently verified using a volt meter and measuring across the terminals. If there is 24 VDC measured across either of the terminals when a start is called, the switch/control is connected incorrectly or is faulty.
	Incorrect Control Voltage	Ensure that the control voltage is present and correctly connected to the transformer inputs (A1& A2 **or** A2 & A3). This can be easily checked using an A.C.volt meter and measuring the voltages at the terminals. Voltages should correspond to those listed on the MSX2 nameplate.
DOL or Uncontrolled Start	Power Factor Correction	Ensure that no Power Factor Correction capacitors are connected on the output of the MSX2. This can cause starter damage. Power factor correction capacitors if fitted must be on the input side of the starter.
Start Current Too High	Start Ramp Time Setting	Check the Start Ramp Time setting. Increase the Start Ramp Time to decrease the start current. High inertia loads should have longer start ramp times. Use of Current Limit start mode will also help to reduce start current.
	Start Voltage Setting	Check the Initial Start Voltage settings. Settings higher than necessary will increase the motor acceleration rate. Settings lower than required will cause the motor to remain stationary for a period before accelerating in response to a Start command.
Motor Does Not Breakaway Immediately	Start Voltage Setting	Check the Initial Start Voltage settings. Settings higher than necessary will increase the motor acceleration rate. Settings lower than required will cause the motor to remain stationary for a period before accelerating in response to a Start command.
Soft Stop Does Not Function	Incorrect Stop Circuit	The soft stop function is not able to work if the start/stop circuit opens the contactor when a stop is called for. Refer to the example soft stop circuit earlier in this manual for correct circuit configuration.
	Stop Ramp Time Setting	Ensure that the Stop Ramp Time is set correctly. If all Stop Ramp Time switches are set to zero (0), no stop time has been specified and there will be no soft stop.

SYMPTOM	POSSIBLE CAUSE	ACTION / TEST
Erratic Motor Operation & Tripping	Large Starter Being Test On Very Small Motor.	Where very small motors are used to test operation of large starters there is possibility that the current drawn may insufficient to latch the starter thyristors. Increase motor size and or loading.

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UNI-STOP SOFT STOP
ADDENDUM

This unit is equipped with a 124 second soft stop function. The following description and DIP Switch Adjustment Panel diagram replace the corresponding sections in the MSX Series Users Manual AMM00076.

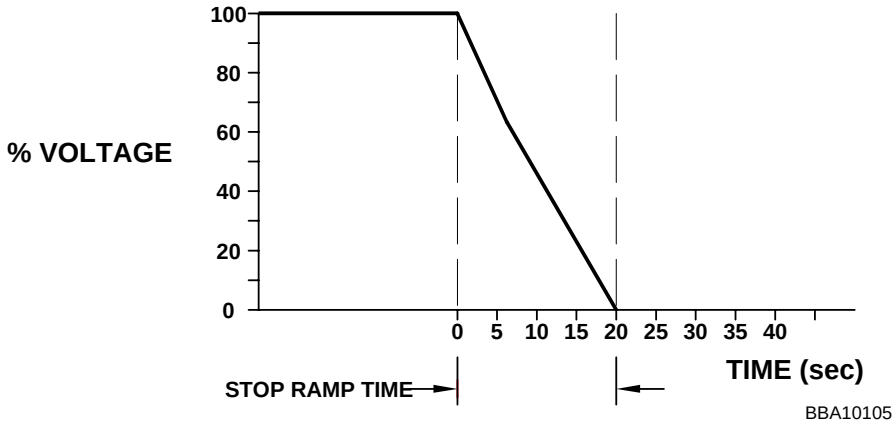
Uni-Stop Soft Stop

This MSX Series soft starter is equipped with a user selectable and adjustable Uni-Stop soft stop function (0s - 124s). Uni-Stop Soft Stop, when enabled, reduces the voltage applied to the motor, causing the motor to stall and decelerate to zero speed. The effect of this is to add inertia to the load and thereby reduce the rate of deceleration.

Uni-Stop Soft Stop technology dynamically adjusts starter output to match the motor characteristics as they change during stopping.

Uni-Stop Soft Stop eliminates the motor instability sometimes experienced with ordinary soft start and soft stop systems. Uni-Stop provides particular advantage in pumping applications where both starting and stopping times can be adjusted to minimise fluid hammer without the need for dedicated 'pump soft start' units.

If utilising the Uni-Stop Soft Stop function and a line contactor, the contactor must not be opened until the end of the stop ramp time.



Overview of MSX Adjustment

The MSX is adjusted via a digital DIP Switch adjustment panel. The following adjustments may be made :