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REEL

Electronic Power Drives

INSTRUCTION AND SERVICING MANUAL

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CONFORMITY DECLARATION

REEL S.r.l. - Via Riviera Berica, 42 - 36024 Ponte di Nanto - VI -

Declares upon own responsibility that the following items:

WAVE3 Supply Unit	**WAVE 3 Capacitor**	**WAVE3 Power Unit**	**WAVE 3 Fan**

satisfy the standards listed below:

CEI EN 61800-3 Product standard for adjustable speed electrical power drive systems

IEC 1000-3-5 1994 Limitations of voltage fluctuations and flicker

IEC 1000-4-2 1995 Electrostatic discharge immunity

IEC 1000-4-3 1995 Electromagnetic field immunity

IEC 1000-4-4 1995 Electrical fast transient/burst immunity

IEC 1000-4-5 Surge immunity

According to the contents of European Directives 89-336 EEC on EMC and 73/23 CEE on Low Voltage.

Ponte di Nanto, 2001

Ezio Bertotto
Product Manager

Giancarlo Verlato
Tecnico CE

Remarks on electromagnetic compatibility

According to EEC 89-336, WAVE 3 drives are considered as "components", and must therefore satisfy the requirements of the specific product regulation. For "semiconductor power converters for adjustable speed electrical drive systems" the regulation is CEI EN 61800-3 (Adjustable speed electrical drive systems).

According to directive 89-336 EEC on EMC and 73/23 EEC on Low Voltage, the product developped and manufactured by REEL S.r.L. is to be considered a BDM (Basic Drive Module).

The BDM along with electromechanical and auxiliary electronic parts compose the CDM (Complete Drive Module).

The CDM along with the motors and sensors inside the machine compose the PDS (Power Drive System).

The PDS only is a complete item that can be certified; the assembling person will take care of the CE marking for the whole machine, basing on the documentation on all components.

The manuals delivered along with the REEL products contain all information to obtain results according to standard CEI EN 61800-3 (Adjustable speed electric drives).

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PRELIMINARY REMARKS

The **WAVE 3** system consists of multi-function vector drives able to control asynchronous and brushless motors.

Through just one supply unit the system feeds several drive units controlling different kinds of motor, thus otimizing the space needed inside the cabinet and allowing remarkable energy saving.

This instruction and service manual was written for **specialized operating personnel in charge of installation, assembling, commissioning as well as servicing** the mentioned multi-drive system.

Such operators are supposed to:

- Have attended a training course on installation, commissioning and servicing of electrical devices and anyway be experienced as regards possible risks and dangers.
- Have attended courses according to the regulations in force for use and servicing on safety devices.
- Know the main physical and electrical system features.
- Know the symbol system used for electrical schemes.
- Know all cabling and wiring procedures as well any detail regarding the use of electrical components.

It is not necessary for such persons to be experienced in the field of frequency converters.

Please read the manual carefully before using any product belonging to the WAVE 3 system; for further technical detail please contact **REEL S.r.l.** by fax or e-mail (reel@reel.it)

The information provided in this manual can be changed without notice.

REEL s.r.l. is not responsible for any mistake contained in the manual or for damages deriving from such mistakes.

REEL s.r.l. is not reliable for any damage deriving from improper or negligent use of the device.

It is forbidden to copy or duplicate parts of this manual without previous written authorization by **REEL s.r.l.** that reserves all rights.

The manual contains three different kinds of indication:

CAUTION!	Indicates not correct actions or behaviors that can generate situations dangerous for the operator. It can also indicate dangers occurring during service operations.
WARNING	Indicates a procedure to be followed or avoided in order to carry out installation, repair or replacement correctly, without any damage to the device.
NOTE	Is used to make further clarify an instruction , repair or any other item.

The indications are provided with the following symbols:

Indicating situations that can generate high danger for the operator. It is always marked with **CAUTION.**

Indicating circumstances under which the **voltage** given can generate **high danger for the operator**. It is always marked with **CAUTION**.

➲ Underlines a **WARNING**.

✓ Means a **NOTE**.

CAUTION

CAUTION!

- Some devices inside the system are under high voltage!

- The access to any system part under voltage can endanger the operator's safety as well as cause the drive's failure.
- Should it be necessary to have access to the device, wait at least 10 minutes after cutting the mains supply before going on with any other operation.

- This manual refers to product versions with default configuration. The setting of special functions or commands may need logics different from the standard to be implemented.

CAUTION!

- Please take special care whenever you see a WARNING! on the WAVE 3 SYSTEM and the accessoire parts used: their text illustrates source and what to do.

- The warning messages used are shown below:

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GLOSSARY

TUNNEL	System consisting of a group of inverters called POWER modules , connected through a power dc bus to a supply unit called SUPPLY . All modules are assembled to build up the TUNNEL.
IGBT	Insulated Gate Bipolar Transistor.
PRECHARGE	Stepwise voltage increase on the capacitor bank on the dc current side of the POWER modules or connected to the tunnel
PWM	Pulse Width Modulation.
DEFAULT VALUES	Values of the software parameters programmed ex factory. To each parameter a default values is assigned during the test phase; such value can be modifies by the user according to the own needs and applications.
V/F	Voltage/Frequency control or Volt /Herz control or scale control mode.
SVC	Space Vector Control. (For the optimal control of one or more standard motors).
FVC	Flux Vector Control. (Pure, highly dynamic vector control with encoder or resolver feedback).
SFT	Stator Flux Torque. (Direct torque control of the new generation. Highest performances in torque control mode, also sensorless).
SB	Sinusoidal Brushless. (Control for permanent magnet brushless motors).
DEVICE	Component able to receive and forward data (POWER; remote I/O etc…)

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GENERAL SAFTY MEASURES FOR THE USER

This charter contains all info regarding the safety measures to be taken by personnel operating with WAVE 3. These are general indications regarding possible risks and the maintenance and servicing on the drives.

Operators and technicians in charge of service must be aware of the dangers related to high voltage and frequency values and must know all related safety measures and procedures.

CAUTION!

- Any service or installation operation on the tunnel or the single modules must be carried out by qualified personnel.
- The tunnel and connected devices must be grounded properly
- Do not act on the tunnel while under voltage. After cutting off the power and auxiliary supply wait for a time indicated in the Installation and service manual before touching the power sections.
- The power modules' output terminals (motor connection) have dangerous voltage when the inverter is supplied, apart from the motor running or not .
- Even when the tunnel is not under voltage (mains supply open and capacitors not charged) there might be voltage inside the tunnel coming from the auxiliary circuits as well as from the external control. When acting on the system utmost caution is needed; all connections have to be cut off, otherwise the persons' safety and life can be endangered.
- Is the motor stopped but the tunnel not cut off from the mains and the capacitors have not been discharged, there might be an accidental motor shaft movement in case of failure or bad working.
- It is forbidden to change the insulation distances or remove insulation materials as well as coverings.

CAUTION!

- **During commissioning and while the tunnel is working operators must follow all detailed safety prescriptions contained in this manual.**

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GENERAL RECOMMENDATION ABOUT THE PRODUCT

WARNING

- All insulation tests on motor and/or connection cables must be carried out after disconnecting the power modules from the cables. Dielectric stiffness tests must not be carried out on inverter parts.
- Do not try and use the system beyond its nominal capacity, otherwise the tunnel could be damaged irreversibly.
- Handle the device with care to avoid damaging of any part.
- Protect the device against not admitted exceeding such as temperature, humidity, blows, shocks, etc..
- Voltage may not be applied on the power module output. It is neither allowed to connect more inverters in parallel on the output nor the direct connection of the input to the inverter output (Bypass).
- No capacity load may be connected to the inverter output (terminals U2, V2 e W2) (for instance phasing capacitors).
- Ground connections have always to be carried out (PE) by using the ground terminal or the grounding bar.
- Use insulated instruments having an adequate scale end For voltage measuring.
- Ensure the system protection against aggressive environments such as:
  - Powder content
  - Dust Air saturated with oil or corrosive agents
  - Volatile coarse-grained dusts obstructing (even partially) the ventilation ducts
  - Chemical or organic agents that lay on surface and thus damage the internal insulations
  - Gas vapors
  - Even poorly conductive material that may affect the parameters of the high impedance circuits
  - Warm and humid environments supporting water condensing on the part being cooled

WARNING

- In case of installation inside conditioned cabinets cut off supply and wait for the temperature to reach a normal level before opening the cabinet's door.
- Carry out periodic service operations according to the indications under paragraph "Regular Servicing" of chapter SERVICING/MAINTENANCE

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WARRANTY

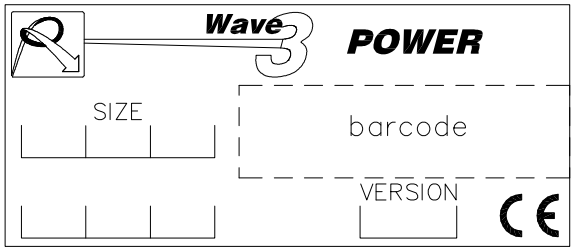
- The warranty granted by REEL regarding the perfect working of the devices means that REEL will repair or replace free of charge at the own premises within the shortest possible time those parts that should fail due to production or defective material during a warranty period of 24 months from delivery date.
- The freight costs for the devices repaired at the Reel premises or the Reel Service Centers are on Customer's charge
- The warranty period for replaced and/or repaired components have a warranty is 6 months from the date of the product sent back to the Customer
- No claim can be laid on REEL for damages occurred during transportation or unpacking
- REEL is not responsible for damages from not correct use of the product or wrong installation or not taking care of the needed measures.
- The warranty declines in case of not correct product use or non observance of chapter"GENERAL CAUTION MEASURES", as well as chapter "MAINTENANCE AND SERVICING".

PRODUCT IDENTIFICATION

Refer to the label on the side of every single module in order to identify construction and working features of the device.

Three different labels show the product family

Power Modules



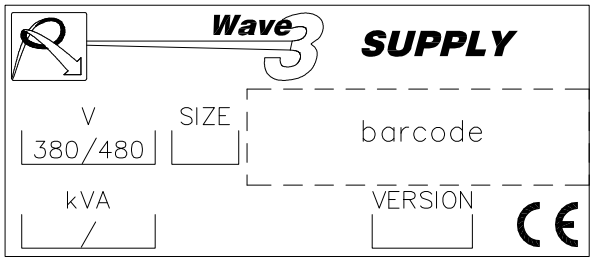
BARCODE: The barcode identifies product typology and order no.

SIZE: Module size according to the nominal current value *.

MODEL/VERSION: The version number is assigned by REEL to distinguish the different options of the same series, to be considered in case of order or spare part demand. [*CONSIDER THE EVIDENCED SIZE ONLY]

V MAX OUT; IN MAX; f OUT: Limit value for the product if used exploiting the maximum features.

Supply modules



BARCODE: The barcode identifies product typology and order no.

V: Indicates the **minimum/maximum** input voltage values. The programming section contains all necessary indications for the voltage selection **kVA**.

kVA: maximum power absorbed by the supply module at the given **min/max voltage values**.

SIZE: Module size

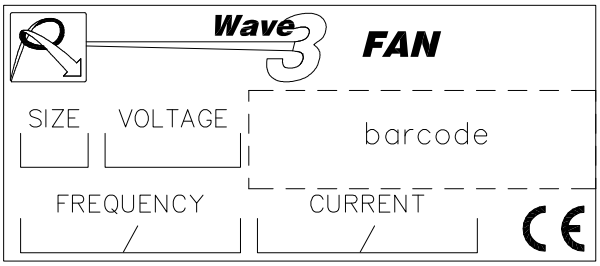
MODEL: The version number is assigned by REEL to distinguish the different options of the same series, to be considered in case of order or spare part demand,

➲ **WARNING**

The version must be looked up in case of spare part demand to determine the perfect compatibility. Should the spare part's version number be different from the installed drive, then the compatibility must be checked by looking up the specific sections under «product version». Follow the instructions contained there or in the documentation related to the module in order to make the part compatible.

Fan modules

Fan modules 02÷03 have a label indicating the technical installation data:



SIZE: The barcode identifies product typology and order no.

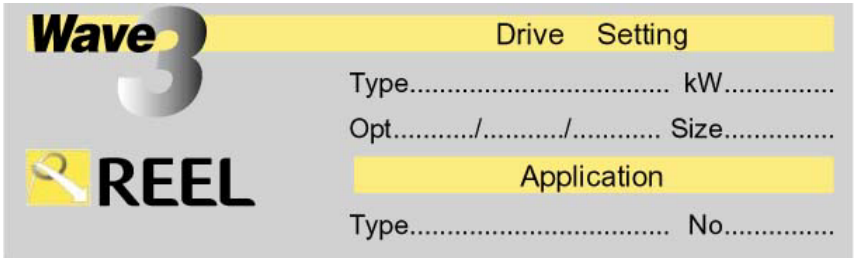
VOLTAGE: Nominal supply voltage

FREQUENCY: Supply Frequency

CURRENT: Current absorbed at the different available supply frequency values.

Setting label

The label must be filled in by the installer and indicates drive configuration and application.



TYPE: - mark the selected control mode: - SVC (Space Vector Control) V/Hz
- FVC (Flux Vector Control)
- SB (Sinusoidal Brushless)
- SFT (Stator Flux Torque)

kW: - mark the kW size of the DRIVE

OPT: - mark the installed option (opt 1.1/2.1/3.1)

SIZE: - mark the set DRIVE size

APPLICATION TYPE: - Mark product application (spindle, 1st shaft, 3rd draw pitch)

NO.: - serial address number assigned to the DRIVE

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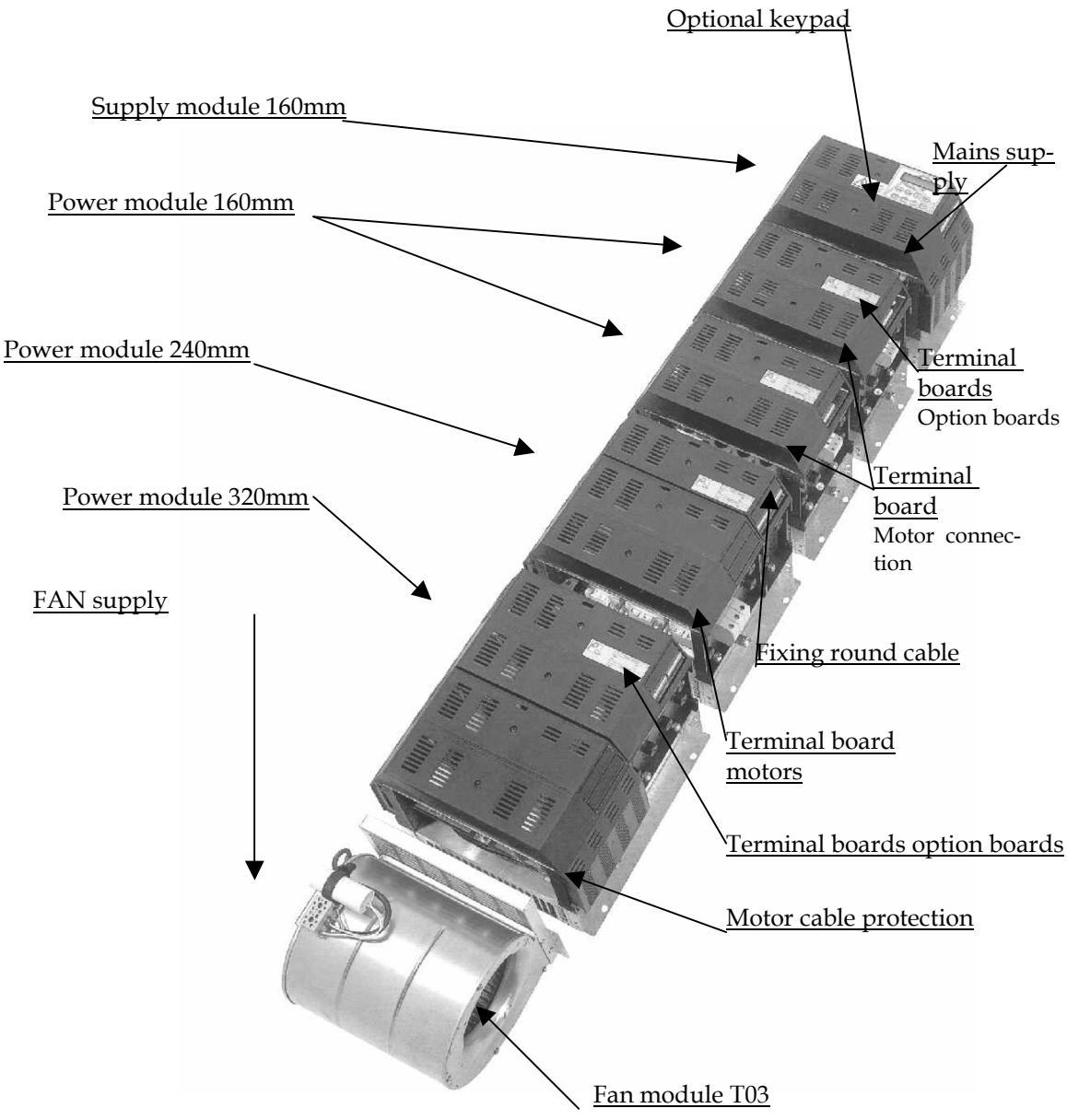
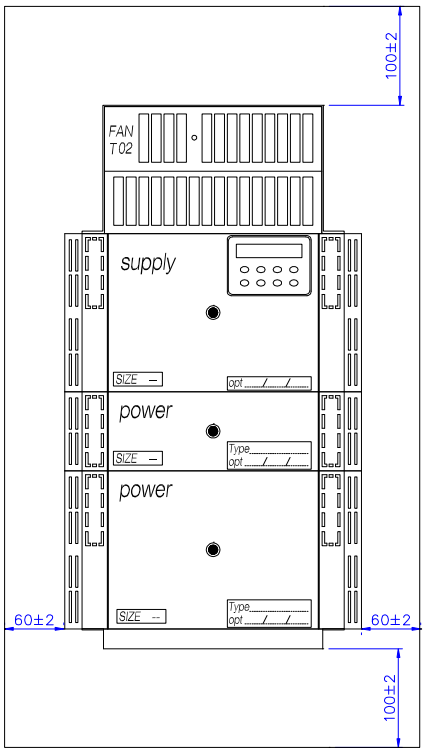
WAVE SYSTEM COMPOSITION



MECHANICAL INSTALLATION

A few general rules should be followed during installation of WAVE 3:

- The tunnel has to be placed away from heat sources and in well ventilated environments
- Although the tunnel was made to be installed in vertical position, it can be placed horizontally as well since it is cooled externally (forced ventilation)
- The system has to be assembled so to be protected against aggressive environments (Read paragraph "General Safety Measures" carefully
- **Provide at least 100mm space both on the upper and lower side as well as around the fan module to grant good cooling. It is recommended to leave 60mm air gap laterally for wiring**



ELECTRICAL INSTALLATION

The information below regard the installing, dimensioning, connecting as well as the wiring outside the drives.

Please see attachments for EU regulations on the EMC directive.

CAUTION! The following operations are subject to electrical risks described in the initial part of the manual

- Power, mains supply and drive-motor decoupling cables must be increased of 15% compared to section needed for the nominal current value, and anyway not below 1,5mm².
- Place three **ultra-quick fuses** before the supply unit, dimensioned according to the unit itself, as per chart below (see chapter "Dimensioning of the ultra-quick fuses").
- Shielded cables are needed for references and feedback, minimum conductor section 0,5mm².
- Carry out the ground connection by keeping the conductor length as short as possible; it is recommended to use separate grounding bars for power and signals, as indicated under chapter "Ground connections".
- In order to reduce the harmonic distortion of the mains current and reduce the input $\Delta i/\Delta t$ a choke is needed between mains supply and drives.
- A EMI/RFI filter might be necessary according to the related regulations; see also chapter "Application of the EEC regulation on the EMC norm"; it is also recommended to install a Philips ferrite ring, type CST26/13/29-452 or compatible on the serial connection terminal boards, near the drives.
- The power cables toward the motor must be shielded in case the same raceway of another conductor should be used or in case of devices sensible to emissions; do not shield the ground cable between drive and motor.
- Adequate filters have to be used for connections where the drives are subject to electrostatic discharges.
- The mains switch has to be chosen according to chart AC1 by adding up the motors' nominal currents and increasing the resulting value of 15-20%.

CAUTION!

Do not place any contactor between motor and drive. If this should be necessary for safety reasons ensure that the contactor is touched only while the drive is off (disabled for at least for 1 second).

- Keep about 100mm free space around the tunnel in order to make thermal dissipation easier.
- The drive must be connected to a regular ground.
- Do not ground the supply 0 point of the control electronics (0; 0A , 0P).
- In case the application requires more motors connected to one inverter, adequate thermal protection must be provided in series to each single motor, disabling the drive when necessary (do not cut the power connection directly).
- If the application requires a dynamic braking resistor a overload protection device in series is needed.
- Do not install the drive on panels subject to strong vibrations directly..
- All parts assembled in side the cabinet (relays, switches, solenoid valves) or fed by common sources must be provided with RC groups or recycling diodes in case of dc supply.
- For tunnels having fan modules WAVE 3 sizes 02/03 the installer has to place adequate mains protections according to the plaque data.
- The drive controls the current to the motor by modifying a direct voltage with variable duty cycle. This system is typical for all PWM drives and has steep switching fronts, producing electromagnetic emissions that can create noise and interference on other sensible devices. The problem grows in case of long power cables.

➲ **WARNING** Long or high-capacity cables can cause the drive block for reasons of protection.

Under such conditions either special cables have to be used, described in the user manual, or chokes or decoupling filters.

GROUND CONNECTIONS

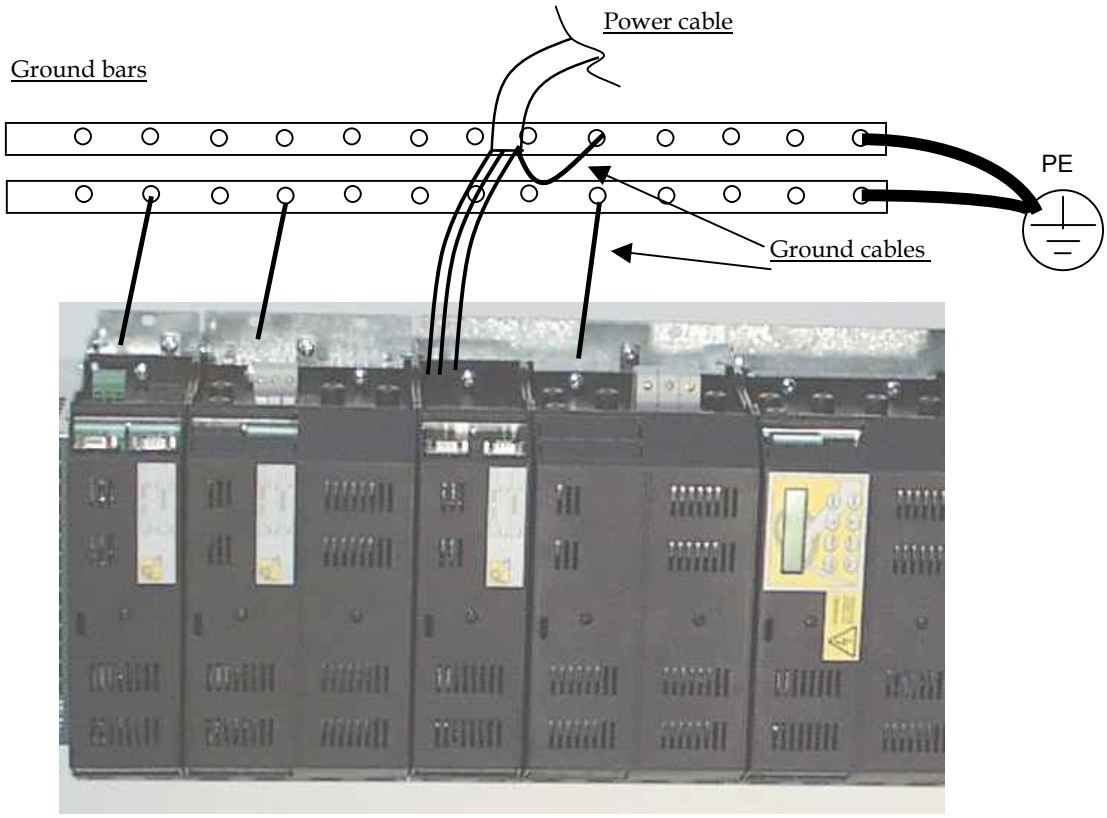
In order to make ground connecting easier, REEL has shaped the metal heat-sink bearing part in a way allowing good grounding of every single module.

It is recommended to install two copper bars, one of them for the power round connections (motor cables, EMC cables shield, etc..) and one for the signal ground (shielded signal cables, metal frame of the W3 modules, etc.), next to the tunnel as showed on the picture below.

The bars are provided with holes and must be mechanically held by insulators.

Connect then the bars to the PE input of the electrical cabinet .

.



✓ **NOTE** The terminal board for the signal cables is made for connection of the related shields as well (shield terminals).

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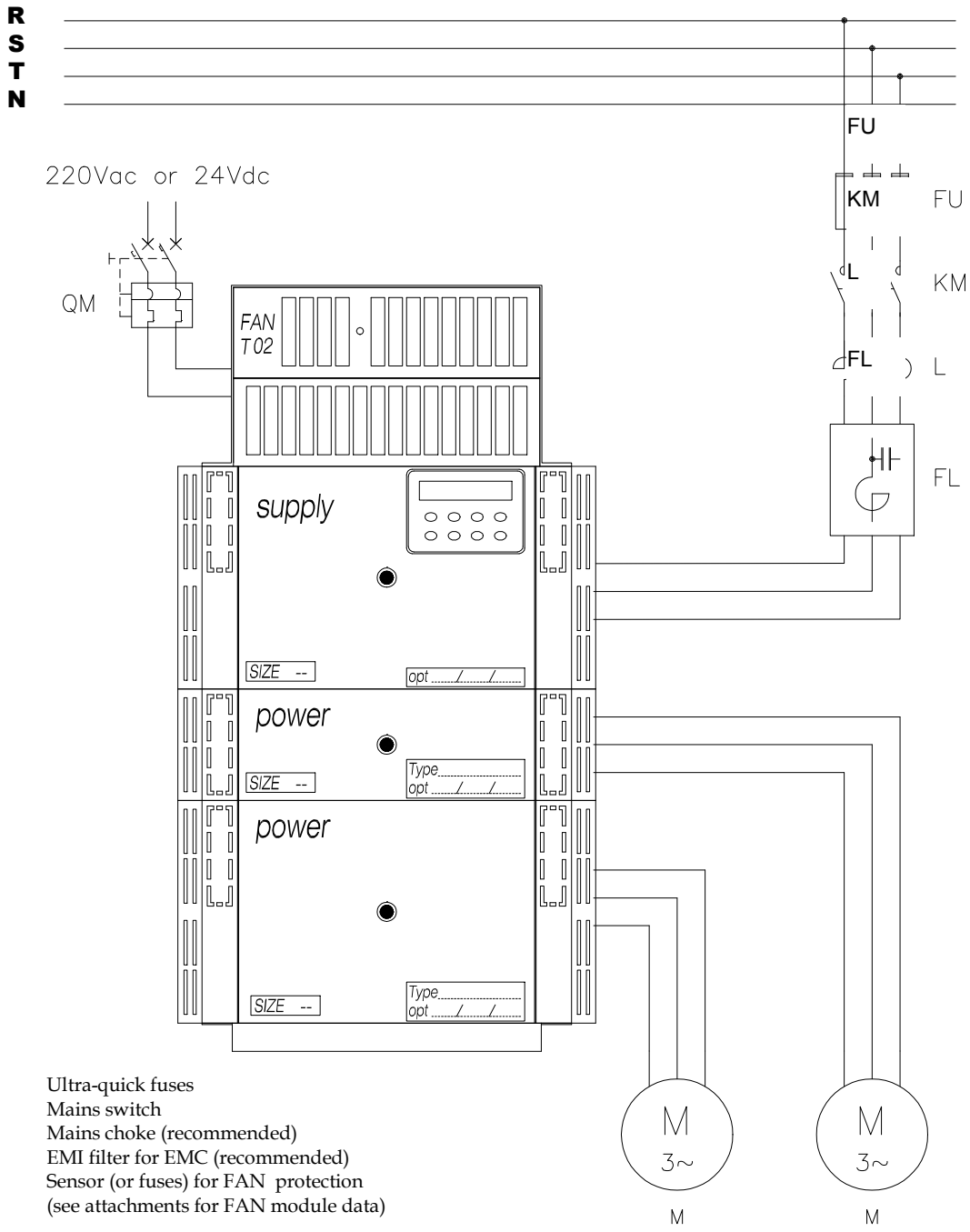
POWER CONNECTION - STANDARD TUNNEL



FU	=	Ultra-quick fuses
KM	=	Mains switch
L	=	Mains choke (recommended)
FL	=	EMI filter for EMC (recommended)
QM	=	Sensor (or fuses) for FAN protection (see attachments for FAN module data)

CAUTION! FAN T01 needs 24V dc supply
FAN T02 and 03 need 220 V dc supply

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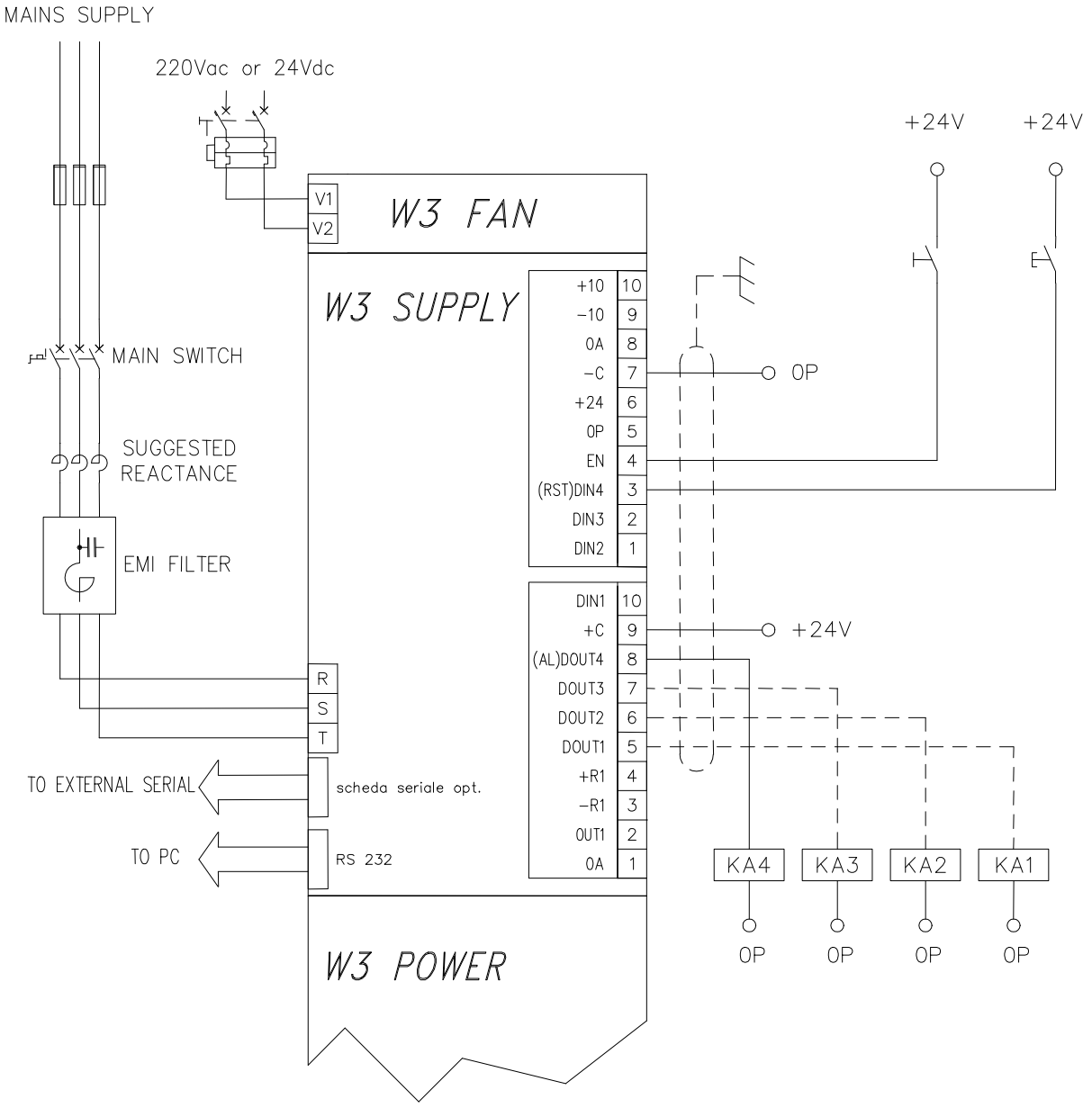
WIRING A STANDARD TUNNEL



✸ according to the sizes as per attachment

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ACCESS TO THE MODULES

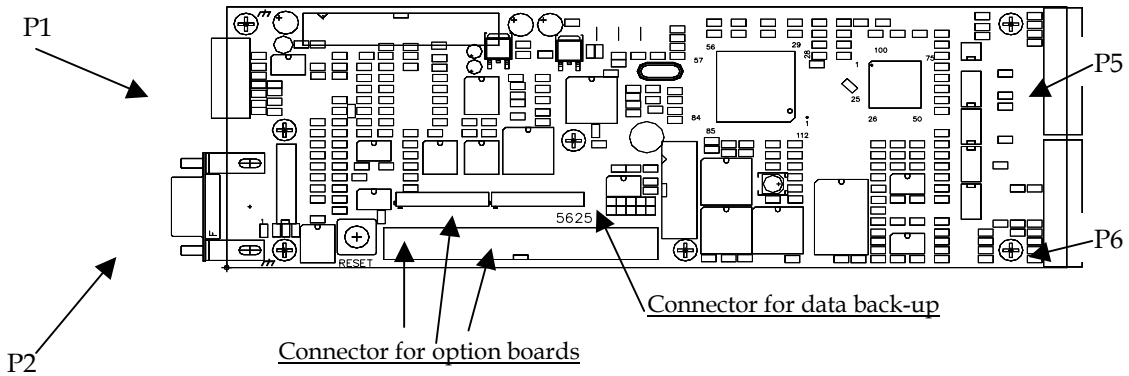
In order to operate on the control boards of the WAVE 3 SYSTEM loose the central screw (or the screws according to the size) with a screwdriver, take off the side supports and remove the cover.

To avoid mixing up the covers look at the label fixed on them informing on the DRIVE SETTING and possible APPLICATIONS.

Please follow the indication in order not to damage the system

SUPPLY UNIT

The control board of the supply unit has the following connectors:



P1 Back-up voltage + Reel serial bus

1	+24	24Vdc from ext. Back-up
2	0P	0Vdc Ext. Back-up
3	In +s	+s input reel serial bus
4	In –s	-s input reel serial bus
5	Out +s	+s output reel serial bus
6	Out -s	-s output reel serial bus

P2 RS232

1	+5
2	Tx
3	Rx
4	n.c.
5	0D
6	+5
7	CTS
8	RTS
9	0D

P5 User Terminal Board 1

1	DIN2	Programmable user input
2	DIN3	Programmable user input
3	DIN4	Programmable user input
4	EN	Ref. Enable (Progr. Input)
5	0P	Zero
6	+24	+24V supply (1,5 A max.)
7	-C	Common for programm. Inputs
8	0A	Analog Zero
9	-10	–10Vdc supply for references
10	+10	+10Vdc supply for references

P6 User Terminal Board 2

1	0A	Analog Zero
2	OUT1	Programmable analog output
3	-R1	+ differential input for reference
4	+R1	- differential for reference
5	DOUT1	Programmable user output
6	DOUT2	Programmable user output
7	DOUT3	Programmable user output
8	DOUT4	Programmable user output
9	+C	Common for programmable outputs
10	DIN1	Programmable user input

NOTE The setting of the programmable user inputs and outputs is described under chapter SYSTEM PARAMETERS

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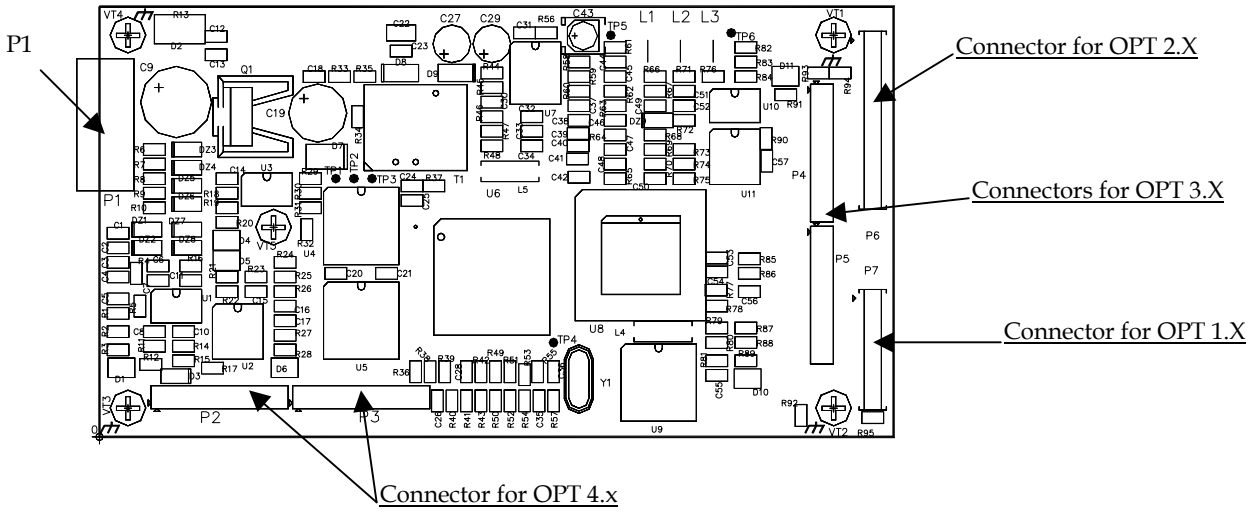
POWER UNIT

The control board of the POWER module has the following connectors:



P1 Back-up voltage +Reel serial bus

1	+24	24Vdc from ext. back-up
2	0D	0Vdc from ext. back-up
3	In +s	+s Reel serial bus input
4	In –s	-s Reel serial bus input
5	Out +s	+s Reel serial bus output
6	Out -s	-s Reel serial bus output

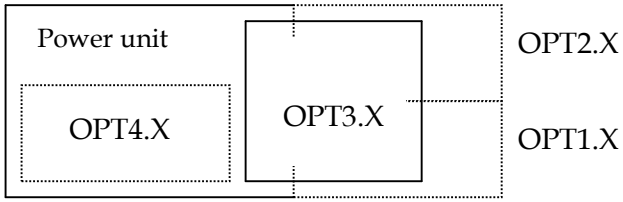
WAVE 3 OPTION BOARDS

Options for control board - SUPPLY unit:

- RS485 with standard WAVE 3 protocol or WAVE 2 compatible
- RS485 with MODBUS
- CANBUS with DEVICENET - 1Mb/s
- PROFIBUS DP - 1,5Mb/s
- Keypad for parameter display
- Data back-up key

Control board –POWER unit:

Placement of the options (ex: OPT 1.X) .



- OPT 1.x
  - OPT1.1 analog reference, frequency inputs (60kHz max) for open collector or Push-pull encoder, configurable as standard I/O as well,2 digital outputs.
- OPT 2.x
  - OPT2.1 14 bit analog input, 2 10bit analog outputs, 3 digital inputs
  - OPT2.2 PC connection for P.L.C applications (to be used as debug only)
- OPT3.x
  - OPT3.1 Resolver input with line driver or open collector encoder simulation output.
  - OPT3.2* Line receiver encoder input, line driver or open collector encoder output
  - OPT3.3* Sine/cos input, line driver or open collector encoder output
- OPT4.x
  - OPT4.1* Standard Sercos communication port
  - OPT4.2* Proprietary Shift register - 4Mbaud

* UNDER DEVELOPMENT

COMMISSIONING

General notes

- The WAVE 3 system is supplied with factory settings except for the size, which is configured according to the construction hardware (when specified).
- The installer in charge shall configure the WAVE 3 system according to the motor features as well as the specific automation field.).

Safety

CAUTION!

Before connecting the tunnel check the following/make sure that :

- An unwanted motor movement does not cause damages to the machine or persons;
- The supply voltage corresponds to the supply unit's nominal features;
- **The power and control connections are carried out correctly**

All connecting and setting operations have to be carried out by qualified personnel.

Before enabling the start check the following:

- Programmable in and outputs must be adequately configured;
- The motor's setting parameters must correspond to the motor itself
- **The function parameters correspond to the drive application**

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Connection

After checking the above mentioned follow the steps below:

- 1 - Disconnect the extractable connectors on the optional parts;
- 2 - Feed the SUPPLY module;
- 3 - Check for the supply module to be ready to start as well as all stabilized voltage supplies to be present;
- 4 - Plug the extractable connectors again;
- 5 - Check for every module to be failure alarm - free;
- 6 - check all specific setting parameters for the POWER module and the motor;
- 7 - Run every POWER module singularly and check for the related motor to turn in the correct sense;
- 8 - Set the system PID's according to the indications contained in the manual.

PROGRAMMING WAVE 3

General Notes

At the moment of installation the drives need some parameters in order to get adequate protection for the specific use.

The standard configuration parameters for the drive are already installed and can be changed or re-installed, for example for adjustment toward the mains or the connected motor, by following the indications below.

The programming is carried out with the built-in keypad (option) or through RS 232.

Programming devices:

1- **Programming keypad**

Keypad + alphanumeric display with two lines and 16 letters.

A remote keypad version is also available, to be connected with a shielded 9 pole cable to RS232, useful when the machine control system is far away.

2- **PC Software**

Communication with the Reel drive from any PC having RS232 (free download from www.reel.it)

Programming keypad

Acts as interface with the WAVE 3 system. Take off the protecting cover, connect the flat cable, place the new cover bearing the keypad and fix it.

The keypad informs on the status (motor revolutions, absorbed current, etc.) or, in case of fault, on the alarm type occurring. 4 languages are available: Italian, English, German, French.

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Programming keys:

"+ - WAVE"

In case of several drives controlled by the unit the display shows the serial code of the selected drive.

"+ - PARAM"

During programming they scroll the parameters for selection.

"+ - SET "

Once the parameter to be modified is chosen the value can be increased or decreased

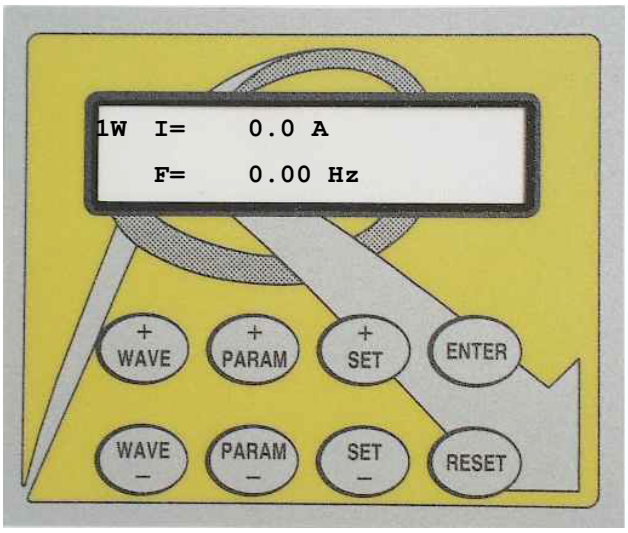
"ENTER"

Access to the programming page

"RESET"

Keypad reset; communication with the drives is stopped and automatically restarted after a few seconds.

The reset key acts on all drives connected in the system; it is deactivated when the system is running .



Parameter input with keypad

After connecting the unit to the drive and feeding, after a few seconds the display shows the menu page .

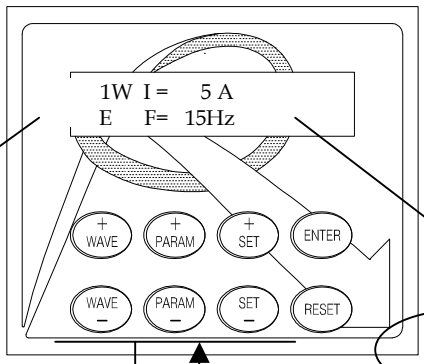
There are two parameter groups for W3:

1. SYSTEM PARAMETERS
2. POWER UNIT PARAMETERS

Access to the Parameters from keypad by pressing **"SET +"** or **"SET –"** and digiting password "1098" for system parameters, "1099" for the power unit parameters.

System Programming

Power Programming



+ SET

- SET

Password 1098

- MAINS FAILURE SETTING
- BAUD RATE RS232
- LANGUAGE
- IGNORE DRIVE ALARM
- KILLER
- ALARM WARNING
- Vnom DC LINK
- I/O CONFIG.
- ALARM MEMORY
- BACK PARAM
- RESTORE PARAM
- KEY LABEL
- COMUNIC. BOARD
- USER PROGRAM
- USER PARAMETERS
- VERSION

+ SET

- SET

Password 1099

- GROUP 1 (Motor Configuration)
- GROUP 2 (Run Config.)
- GROUP 3 (Drive Config.)
- GROUP 4 (I/O Config.)
- GROUP 5 (PID Config.)
- GROUP 6 (User Config.)

+ PARAM

- PARAM

EXIT

With keys :

±WAVE	POWER unit selection,
±PARAM	parameter selection/ password selection
ENTER	enters the parameters/ password confirmation
SET±	edits values/set of the password figures

Programming with PC

Serial communication through RS 232 or RS485 (option).

Reel supplies a communication software for the own drives easy to load on any IBM or WINDOWS 9x or NT compatible PC. (Download from www.reel.it).

The communication is activated by clicking on the related window on the DESKTOP.

The program communicates at one time with up to 31 drives connected to a single serial knot. The OFF-LINE mode allows reading a previously ON-LINE configured system.

See software program manual for further reference.

SYSTEM PARAMETERS

The system parameters refer to the whole tunnel and must therefore be set by the user basing on the kind of installation. (for instance, I/O configuration voltage, etc.).

Mains Failure Control Menu

ID	PARAMETER	RANGE	DEFAULT	AVAILABLE SELECTION
59	HOLD	0 ÷ 5	1	Kind of Mains Failure handling
20	M1	0 ÷ 100	100	Inertia from motor n°1
21	M2	0 ÷ 100	0	Inertia from motor n°2
22	M3	0 ÷ 100	0	Inertia from motor n°3
23	M4	0 ÷ 100	0	Inertia from motor n°4
24	M5	0 ÷ 100	0	Inertia from motor n°5
25	M6	0 ÷ 100	0	Inertia from motor n°6
26	M7	0 ÷ 100	0	Inertia from motor n°7
27	M8	0 ÷ 100	0	Inertia from motor n°8
28	M9	0 ÷ 100	0	Inertia from motor n°9
29	M10	0 ÷ 100	0	Inertia from motor n°10
30	KP_mr	0÷1000	500	Constant proportional setting of the Mains Failure function PID
31	KI_mr	0 ÷1000	500	Constant linear setting of the Mains Failure function PID
32	KD_mr	0÷1000	500	Constant derivative setting of the Mains Failure function PID

ID	PARAMETER	RANGE	DEFAULT	AVAILABLE SELECTION
48	TauD	0 ÷1000	0ms	Filter time constant on the derived Mains Failure Control PID.
42	KP_aux	0÷1000	500	Constant proportional setting of the Mains Failure function auxiliary PID.
43	KI_aux	0÷1000	500	Constant integral setting of the Mains Failure function auxiliary PID
44	KD_aux	0÷1000	500	Constant derivative setting of the Mains Failure function auxiliary PID.
45	TauD	0÷1000	Oms	Filter time constant on the derived Mains Failure Control auxiliary PID.
46	-	-	-	-
33	DI	0÷1000	30.0s	Deceleration coefficient for the start of Mains Failure handling
34	RmK	0 ÷ 20.00	0%	Machine speed percentage to start dc braking on ac motors
35	KM	0 ÷ 300	5.0%	Average slip of the motors driven by the system
36	PNDm	0 ÷ 10'000	2	Max. acceleration gradient limit calculated by the PID
37	KG	0,01÷50.00	1.00	PID Multipl. factor according to the instant line speed
38	KL	0 ÷ 1999	50	PID gain adaptor (depending on inertia load) according to the line speed
39	I0	0 ÷ 100	30%	Average of the motor current values without load basing on the nominal plate values.
40	V0_mr	0 ÷ 201	5%	Voltage BOOST optimisation during mains failure control
41	T_mr	500 ÷ 2000	500ms	Minimum time mains failure loop
47	Smk%	0,0 ÷ 100,0	0%	Minimum speed threshold, below which speed does not go back to the previous value during a mains failure
48	TauD	0 ÷1000	0ms	Filter time constant on the derived mains Failure control PID.
49	-	-	-	-
50	Hold	1	-	Mains failure control selection: 0=No control 1=Standard energy recovery 2=Energy recovery with differential stop 3=Supply from DC bus (m.f. not controlled) 4=Control through a master drive 5=Control through several independent drive groups

Baud Rate menu RS232

N°	PARAMETER	DEFAULT	UNIT	SELECTIONS
4	Baud Rate RS-232	19200	b.p.s.	Baud rate selection for RS 232: 9600 38400 19200 57600
5	Error check	0	-	0=CRC-CCITT 1=CKS (XOR)

Language menu

N°	PARAMETER	DEFAULT	UNIT	SELECTIONS
7	LANGUAGE	ENGLISH	-	Italian, English, German French

Ignore drive alarm

N°	PARAMETER	DEFAULT	UNIT	SELECTIONS
1	Ignore drive alarm	DISABLED	-	DISABLED = handles all alarms ENABLED = ignores all alarms

Killer menu

N°	NAME	DEFAULT	UNIT	SELECTIONS
62	KILLER	0.000	s	Max. activation time dynamic brake 0,000 ÷ 10,000 0.000 = Killer disabled

Thermal warning menu

N°	NAME	DEFAULT	UNIT	SELECTIONS
60	PREWARNING	0,0	s	Thermal warning alarm selection0.0 ÷ 20.0 s 0,0 = warning disabled

Vnom dc link menu

N°	NAME	DEFAULT	UNIT	AVAILABLE SELECTION
65	Vnom	400	Vac	Tensione nominale di rete che alimenta il sistema, da 380÷500Vac

Tunning Parameter:

Reading parameters; configuration reserved

N°	NAME	DEFAULT	RANGE	SELECTIONS
	ADC_TAR_ DClink	-	-	Setting value for OFFSET compensation
	Vac_TAR_D Clink	_	_	Setting value for OFFSET compensation
	Vmax DC	800	400 ÷ 900	Max. voltage alarm value on DC link
	OFF-SET ntc	-	-	Ambient temperature error adjustment set

I/O Config. menu

<table>
<tr><th>N°</th><th>NAME</th><th>DEFAULT</th><th>RANGE</th><th>SELECTIONS</th></tr>
<tr><td>70</td><td>Input polarity</td><td>0</td><td>0÷F</td><td>Polarity inputs DIN1, DIN2, DIN3, DIN4 : 0÷F

<table>
<tr><th>SET</th><th>DIN1</th><th>DIN2</th><th>DIN3</th><th>DIN4</th></tr>
<tr><td>0=</td><td>H</td><td>H</td><td>H</td><td>H</td></tr>
<tr><td>1=</td><td>L</td><td>H</td><td>H</td><td>H</td></tr>
<tr><td>2=</td><td>H</td><td>L</td><td>H</td><td>H</td></tr>
<tr><td>3=</td><td>L</td><td>L</td><td>H</td><td>H</td></tr>
<tr><td>4=</td><td>H</td><td>H</td><td>L</td><td>H</td></tr>
<tr><td>5=</td><td>L</td><td>H</td><td>L</td><td>H</td></tr>
<tr><td>6=</td><td>H</td><td>L</td><td>L</td><td>H</td></tr>
<tr><td>7=</td><td>L</td><td>L</td><td>L</td><td>H</td></tr>
<tr><td>8=</td><td>H</td><td>H</td><td>H</td><td>L</td></tr>
<tr><td>9=</td><td>L</td><td>H</td><td>H</td><td>L</td></tr>
<tr><td>A=</td><td>H</td><td>L</td><td>H</td><td>L</td></tr>
<tr><td>B=</td><td>L</td><td>L</td><td>H</td><td>L</td></tr>
<tr><td>C=</td><td>H</td><td>H</td><td>L</td><td>L</td></tr>
<tr><td>D=</td><td>L</td><td>H</td><td>L</td><td>L</td></tr>
<tr><td>E=</td><td>H</td><td>L</td><td>L</td><td>L</td></tr>
<tr><td>F=</td><td>L</td><td>L</td><td>L</td><td>L</td></tr>
</table>
H = ACTIVE INPUT HIGH

L = ACTIVE INPUT LOW</td></tr>
</table>

N°	NAME	DEFAULT	RANGE	SELECTIONS
71	DIN1 Config	0000	0÷FFFF	DIN1 configuration: 0000 = USER (available for user program) 0001 = Drive ON 0002 = RUN CW 0004 = RUN CCW 0008 = EN1 0010 = EN2 0020 = RESET (can be executed in Broadcast only) 0040 = STROBE 0080 = MOTOR CATCH
72	DIN2 Config	0008	0÷FFFF	DIN2 configuration : like DIN1
73	DIN3 config.	0001	0÷FFFF	DIN3 configuration: like DIN1
74	DIN4 config.	0000	0÷FFFF	DIN4 configuration : like DIN1
86	DIN1 destination	0	0÷31	Destination DIN1 on Drive n°: 0 = all (broadcast) 1÷31 ⇒ Drive 1÷31
87	DIN2 destination	0	0÷31	Destination DIN2 on Drive n°: 0 = all (Broadcast) 1÷31 ⇒ Drive 1÷31
88	DIN3 destination	0	0÷31	Destination DIN3 on Drive n°: 0 = all (BROADCAST) 1÷31 ⇒ Drive 1÷31
89	DIN4 destination	0	0÷31	Destination DIN4 on Drive n°: 0 = all (BROADCAST) 1÷31 ⇒ Drive 1÷31

<table>
<tr><th>N°</th><th>NAME</th><th>DEFAULT</th><th>RANGE</th><th>SELECTIONS</th></tr>
<tr><td>75</td><td>Output po-larità</td><td>1</td><td>0÷F</td><td>Polarity outputs DOUT1, DOUT2, DOUT3, DOUT4 : 0 ÷ F

<table>
<tr><th>SET</th><th>DOUT1</th><th>DOUT2</th><th>DOUT3</th><th>DOUT4</th></tr>
<tr><td>0=</td><td>H</td><td>H</td><td>H</td><td>H</td></tr>
<tr><td>1=</td><td>L</td><td>H</td><td>H</td><td>H</td></tr>
<tr><td>2=</td><td>H</td><td>L</td><td>H</td><td>H</td></tr>
<tr><td>3=</td><td>L</td><td>L</td><td>H</td><td>H</td></tr>
<tr><td>4=</td><td>H</td><td>H</td><td>L</td><td>H</td></tr>
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<tr><td>7=</td><td>L</td><td>L</td><td>L</td><td>H</td></tr>
<tr><td>8=</td><td>H</td><td>H</td><td>H</td><td>L</td></tr>
<tr><td>9=</td><td>L</td><td>H</td><td>H</td><td>L</td></tr>
<tr><td>A=</td><td>H</td><td>L</td><td>H</td><td>L</td></tr>
<tr><td>B=</td><td>L</td><td>L</td><td>H</td><td>L</td></tr>
<tr><td>C=</td><td>H</td><td>H</td><td>L</td><td>L</td></tr>
<tr><td>D=</td><td>L</td><td>H</td><td>L</td><td>L</td></tr>
<tr><td>E=</td><td>H</td><td>L</td><td>L</td><td>L</td></tr>
<tr><td>F=</td><td>L</td><td>L</td><td>L</td><td>L</td></tr>
</table>
H = USCITA ATTIVA ALTA
L = USCITA ATTIVA BASSA</td></tr>
<tr><td>76</td><td>DO1 config</td><td>0001</td><td>0÷FFFF</td><td>Output DO1 configuration:
0000 = User (Available for user progr.)
0001 = Alarm (OR with source = 0)
0002 = mSR (AND with source = 0)
0004 = Power-failure (OR with source = 0)
0008 = Rotation direction (OR with source = 0)
0010 = Set point reached (AND with source = 0)
0020= Brake (OR with source = 0)
0040= Thermal alarm (OR with source = 0)</td></tr>
<tr><td>77</td><td>DO2 config.</td><td>0002</td><td>0÷FFFF</td><td>Config. Output DO2: like DO1</td></tr>
<tr><td>78</td><td>DO3 config.</td><td>0000</td><td>0÷FFFF</td><td>Config. DO3: like DO1</td></tr>
<tr><td>79</td><td>DO4 config.</td><td>0000</td><td>0÷FFFF</td><td>Config. DO4: like DO1</td></tr>
</table>

N°	NAME	DEFAULT	RANGE	SELECTIONS
82	Source DO1	0	0÷31	Determines the source activating DO1: 0 = All 1÷31 = Drive 1÷31
83	Source DO2	0	0÷31	Determines the source activating DO2: 0 = All 1÷31 = Drive 1÷31
84	Source DO3	0	0÷31	Determines the source activating DO3: 0 = All 1÷31 = Drive 1÷31
85	Source DO4	0	0÷31	Determines the source activating DO4 0=All 1÷31 = Drive 1÷31
80	Analog input R1	0000	0÷FFFF	Analog input +/- R1 0000 = User 0001 = Kappa 0002 = Ref1
92	R1 destina-tion.	0	0÷31	Destinat. Analog input R1 0 = broadcast 1-31 = drive 1-31
81	Analog out-put ANA O		0÷FFFF	Configuration ANA output 0: (±10V) 0000 = User 0001 = DC-Link voltage (of display, not depending on ANA 0 source) 0002 = Drive Frequency 0004 = Drive Speed 0008 = Drive Current
90	ANA O Source	1	1÷31	Determines the source activating output ANA 0: 1÷31 = Drive 1÷31
91	T_ANA O	10ms	0÷1000	Filter analog OUT ANA 0 (0÷1 sec.)

Alarm memory menu

N°	NAME	DEFAULT	KEYS	SELECTIONS
1	--	--	PAR±	Displays the latest 32 alarms in their occurring order. 1 = last one occurred
2	Delete Me-mory	NO	SET±	Allows deleting the alarm memory: NO = do not delete YES = dolete

Parameter backup menu

N°	NAME	DEFAULT	KEYS	SELECTIONS
1	Param. Backup	NO	SET±	Enables the backup of all system parameters on data key: NO = Not allowed YES =Start Back-up

Parameter restore menu

N°	NAME	DEFAULT	KEYS	SELECTIONS
1	Restore param.	NO	SET±	Allows restoring al system parameters from back up key: NO = Not allowed YES =Restore

Key label menu

N°	NAME	DEFAULT	KEYS	SELECTIONS
1	Key label	-	SET±	Assigns the key a 16 character identification string chosen by the user

Communication board menu

N°	NAME	DEFAULT	KEYS	SELECTION
1	Depends on OPT	-	SET±	Detects the communication board used (rs485, Can etc) and allows entering the parameters if available.

User program menu

N°	NAME	DEFAULT	KEYS	SELECTIONS
1	Exe enable	NO	SET±	Enables the user program execution: YES or NO
8	Cycle time	10 ms	SET±	Cycle time set of the user program. Range 1 ÷ 50ms
2	Debug mode	DISABLED	SET±	Enables or disables the debug mode
3	Save program	NO	SET±	Saves the user program: YES or NO
4	Delete prg.	NO	SET±	Deletes the user program: YES or NO

back

User parameters menu

N°	NAME	DEFAULT	KEYS	SELECTIONS
1	P0÷P127	-	PAR±	User parameters
2		FFFF	SET±	User parameters value

VERSION MENU

Displays the Fimware version, both for the Main Program and the logic (FPGA) ex:

Program:

WAVE3 – MASTER
xxxxxRR dd mm yy

Where:

RR = program version

dd mm yy = creation date

Logic :

FIRMWARE FPGA
RR – dd mm yy

Exit menu

Press **ENTER** to exit the system parameters or, from any position, press twice **ENTER** quickly .

Press **+/- PARAM** to continue

POWER UNIT PARAMETERS

For each POWER module of the WAVE3 system the set parameters can be optimized according to the user's specific application.

The parameters for each POWER unit are divided into groups, GROUP1 to 6, having different configurations; they can be scrolled with keys **PARAM +** e **PARAM -.**

Once the concerned POWER unit is identified (see chapter "Power unit programming") by using keys **WAVE+** and **WAVE ,** press SET+ o SET- to enter the group parameters, digit the POWER related password (1099) , confirm with ENTER and select the parameter group with SET+ or SET -.

Select the parameter with **PARAM +** and **PARAM –** .

Increase o r decrease its value with **SET+** e **SET –**

Press **ENTER** twice to exit the POWER unit parameter programming and go back to the main menu.

The parameter groups are described in the following pages. The respective control mode is indicated on the chart's right side under "@" according to the setting.

SVC (Space Vector Control) = Voltage vector control

FVC (Flux Vector Control) = Vector control

SFT (Stator Flux Torque) = Direct Torque Control

SB (Sinusoidal Brushless) = Sinusoidal brushless control

NOTE **# stresses that the parameter can be set "OFF-LINE" only, (Drive not running).**

@ shows the control mode in which the parameter is active.

Group 1 (Motor Configuration)

No	NAME	DEFAULT	UNIT		SVC	FVC	SFT	SB
1	IaN #	2.00	Amp	Nominal motor current	@	@	@	@
2	IMAX #	4.00	Amp	Allowed overload current	@	@	@	@
3	ULN #	400	Volt	Nominal voltage applied to the motor	@	@	@	@
4	FLN #	50	Hz	Nominal motor frequency	@	@	@	
5	FMAX #	50.0	Hz	Max. working frequency	@	@	@	
6	Nn #	1450	rpm	Nominal motor rpm	@	@	@	@
7	nMAX #	1500	rpm	Max working speed		@	@	@
8	Cos phi #	0,85		Power factor		@	@	
9	Poles #	4		Determines the number of pole pairs		@	@	@
10	Rs #	0		Phase resistor for Y-connected motors or 1/3 of the phase resistor for delta connected motors	@	@	@	@
11	SLS #	0	mH	Stator inductance	@	@	@	@
12	Tau R #	0	ns	Time constant of the stator Rl circuit		@	@	@

Group 2 (Run Configuration)

N°	NAME	DEFAULT	UNIT		SVC	FVC	SFT	SB
13	Fmin#	0	Hz	Processing start frequency	@			
14	V1	0	Volt	Voltage applied to the motor at frequency F1	@			
15	f1	0	Hz	Reference frequency for the processing of a linear V/F ration change	@			
16	V0	10	Volt	Voltage given to the motor for RI compensation (torque optimization at low rpm)	@			
17	F0	30	Hz	Frequency value at the end of V0 (link to V/F)	@			
18	ACC	10.00	sec	Acceleration time at start	@	@	@	@
19	DEC	10.00	sec	Deceleration time at stop	@	@	@	@
20	Ramp	10.00	sec	Time variation on speed set	@	@	@	@
21	Timax	1.0	Sec	Overload limit time I^2t for the motor	@	@	@	@
22	Tbrake	0.0	Sec	Brake handling time (if programmed.)	@	@	@	@
23	msr_Hz	0,3	Hz	Minimum speed relay threshold in Hz	@			
24	msr_rpm	5	Rpm	Minimum speed relay in rpm		@	@	@
25	T_cong	0.0	Sec	Limit duration time for congruence error		@	@	@
26	S_cong	0	Rpm	Window in revolutions for congruence error handling		@	@	@
27	X1	0	V	Dc injection at 0 speed (parameter for mains failure control handling)	@	@	@	
28	Tw_fil	0	ms	Filter time constant on the speed detecting	@	@	@	@
29	I Search	30	%	Nominal current percentage used to search for "motor speed " in the motor catch handling	@			
30	Search	5	s	Search time for "motor speed " in the motor catch handling	@			

Group 3 (Drive configuration)

N°	NAME	DEFAULT	UNIT		SVC	FVC	SFT	SB
31	Type #	0	-	Defines the control mode: 0 = SVC (Space Vector Control) V/Hz 1 = FVC (Flux Vector Control) 2 = SB (Sinusoidal Brushless) 3 = SFT (Stator Flux Torque)	@	@	@	@
32	Size #	19.0	-	Module size (see size chart)	@	@	@	@
33	PWM #	2.00	KHz	Modulation frequency: 2.0 = 2 kHz 2.1 = 2.1 (random 2 kHz ± 500 Hz) 4.0 = 4 kHz 4.1 = 4.1 (random 4 kHz ± 500 Hz) 8.0 = 8 kHz 8.1 = 8.1 (random 8 kHz ± 500 Hz) 12.0 = 12 kHz 16.0 = 16 kHz	@	@		@
34	Setup #	0 0CE	-	Assignment of the drive commands the serial port 0 = all Hardware commands	@	@	@	@
35	R1#	4	-	Configuration 1st reference: 0000 = User 0001 = Analog from OPT1 0002 = Analog from OPT2 0004 = from serial bus (1) 0008 = from serial bus (2) 0010 = 4÷20 mA from OPT2	@	@	@	@
36	R2#	0	-	Configuration 2nd reference: 0000 = User 0001 = Analog from OPT1 0002 = Analog from OPT2 0004 = from serial bus (1) 0008 = from serial bus (2) 0010 = 4÷20 mA from OPT2	@	@	@	@
37	*Jog1	100	Rpm	Pulse speed 1	@	@	@	@
38	*Jog2	1000	Rpm	Pulse speed 2	@	@	@	@
39	Enc_Out	1024	ppR	Pulse/rev of the encoder simulation output				@

N°	NAME	DEFAULT	UNIT		SVC	FVC	SFT	SB
40	Enc_in #	1024	P.p.R.	Nominal pulse/rev of the encoder	@	@	@	
41	Type-Enc #	0 (SVC) 1 (FVC)	-	Encoder type: 0 = Unidirectional (standard on SVC) 1 = Bidirectional (standard on FVC)	@	@	@	
42	Bit_Res #	14	BpR	Resolver conversion resolution				@
43	Off.res #	8181	-	Resolver offset (Tuning)				@
44	Hold	1	-	Configuration for mains failure control: 0 = No control (drive keeps running) 1 = Standard Reel control (Energy Recovery) 2 = Controlled stop 3 = Not controlled stop	@	@	@	@
45	Off AN1	0		Analog input offset OPT1	@	@	@	@
46	Off AN2	0		Analog input offset OPT2	@	@	@	@
47	R1_memo	0		Digital speed reference saving	@	@	@	@
48	Select #	0		Selects the available macros: 0 = none 1 = Electronic Traverse	@	@	@	@
49	Tab_VHz #	0		SVC type selection: 0 = open speed loop 1 = closed speed loop	@			
50	Group Hold	0		Group belonging of the drive during mains failure control (0-4 0=none)	@	@	@	@

* Under development

Group 4 (I/O configuration parameters)

N°	NAME	DEFAULT	UNIT		SVC	FVC	SFT	SB
51	Din1 #	11	-	Functions of the programmable digital input for DIN1 functions assignment : 0 = Disabled 1 = ON 2 = En 3 = CW/CCW 4 = EN1+CW 5 = EN1+CCW 6 = EN2 7 = ALARM RESET 8 = TUNE RESOLVER 9 = el. Traverse set 10 = therm. motor protection 11 = Encoder CHA (CHBxDIN2) 12 = unid. Encoder input (Possible for DIN2 only) 13 = enable motor catch	@	@	@	@
52	Din2 #	11	-	Functions of the programmable digital input for DIN2 functions assignment	@	@	@	@
53	Din3 #	0	-	Functions of the programmable digital input for DIN3 functions assignment	@	@	@	@
54	Din4 #	1	-	Functions of the programmable digital input for DIN4 functions assignment	@	@	@	@
55	Din5 #	2	-	Functions of the programmable digital input for DIN5 functions assignment	@	@	@	@
56	Din6 #	3	-	Functions of the programmable digital input for DIN6 functions assignment	@	@	@	@
57	DO1	5	-	Functions of the programmable digital output for the DO1n functions assignment: 0 = Disabled 1 = msr 2 = BRAKE 3 = SPEED REACHED 4 = ROTATION SENSE 5 = ALARM (Start release)	@	@	@	@
58	DO2	1	-	Functions of the programmable digital output for the DO2 functions assignment.	@	@	@	@
59	Out1	1	-	Functions of the programmable analog output for the OUT1 functions assignment : 0=disabled 1=SPEED OUTPUT (± 10V) 2=CURRENT OUTPUT (± 10V) 3=DC LINK VOLTAGE OUTPUT 0÷10V (10=1000Vdc)	@	@	@	@

N°	NAME	DEFAULT	UNIT		SVC	FVC	SFT	SB
60	Out2	2	-	Functions of the programmable analog output for the OUT2 functions assignment: like Out1	@	@	@	@
61	Offout1	0	-	Offset for analog outputs Out1	@	@	@	@
62	Offout2	0	-	Offset for analog outputs Out2	@	@	@	@
63	tw_out1	10	ms	Time constant PB filter on analog output Out1.	@	@	@	@
64	tw_out2	10	ms	Time constant PB filter on analog output Out2.	@	@	@	@

Group 5 (PID configuration)

N°	NAME	DEFAULT	RANGE		SVC	FVC	SFT	SB
71	KpI	300	0÷30000	Proportional constant of the current control	@	@		@
72	KiI	300	0÷30000	Integral constant of the current control	@	@		@
73	Kpw	300	0÷30000	Proportional constant of the speed control	@	@		@
74	Kiw	20	0÷30000	Integral constant of the speed control	@	@		@
75	Kdw	0	0÷30000	Derivative constant of the speed control	@	@		@
76	tdw	15	0÷1000	Filter band width on feedback for Kdw constant	@	@		@
77	Kpflx	40	0÷30000	Proportional constant of the flux control		@		
78	Kiflx	1	0÷30000	Integral constant of the flux control		@		
79	R2a	0	0÷100,0	Absolute constant auxiliary PID control	@	@	@	@
80	R2p	0	0÷100,0	Proportional constant auxiliary PID control	@	@	@	@
81	R2i	0	0÷32000	Integral constant auxiliary PID control	@	@	@	@
82	R2d	0	0÷32000	Derivative constant auxiliary PID control	@	@	@	@
83	R2td	0	0÷32000	Filter Band width setting for the derivative constant of the auxiliary PID control	@	@	@	@

Group 6 (User configuration)

The parameters below are available depending on the control mode and the selected macros.

The values taken by the parameters are shown in the annex, according to the selected macro

N°	NAME	DEFAULT	RANGE	
85÷106	Usr0÷21	-	0 ÷ 65.535	User parameter depending on selected mode and macro

Mains failure control parameters (Active if the power unit acts as mains failure master)

N°	NAME	DEFAULT	RANGE		SVC	FVC	SFT	SB
65	Ramp_V dc	0.50	0÷30000	Raising time for the DC BUS at the catching in case of mains failure	@	@	@	@
66	Kp_Vdc	700	0÷30000	Master configuration : - Proportional constant of the voltage loop. Slave configuration: - Compensation level of the DC LINK voltage- SVC control mode – during mains failure control	@	@	@	@
67	Ki_ Vdc	500	0÷30000	Integral constant of the voltage loop.	@	@	@	@
68	Kd_Vdc	500ms	0÷30000	Derivative constant of the voltage loop.	@	@	@	@
69	Td_Vdc	500ms	0÷1000	Filter band width on the feedback for the Kd_Vdc constant	@	@	@	@

Internal Communication

N°	NAME	DEFAULT		SVC	FVC	SFT	SB
110	CLS1_out	8C01	For expert users only	@	@	@	@
111	CLS2_out	8C01	For expert users only.	@	@	@	@
	…….	0000	For expert users only	@	@	@	@
119	CLS1_in	8022	For expert users only	@	@	@	@
120	CLS1_in	8064	For expert users only	@	@	@	@
	……	000	For expert users only	@	@	@	@

MAINTENANCE AND SERVICING

Caution measures

- Servicing on the tunnel may be carried out by qualified personnel only, since some parts of it are under high voltage while running.
- Careless behaviour may cause death or heavy injuries to persons or damage things.
- Before starting any operation on the drive disconnect it from the mains and wait at least 10 minutes before touching parts under voltage, as there might still be dangerous voltage on the capacitors of the intermediate circuit.
- The maintenance personnel must have read this manual thoroughly.
- See attached diagrams to identify the different drive parts.

Periodical servicing

The WAVE 3 system scheduled servicing on the FAN and CAPACITOR modules only. The other modules just need a clean and dust-free environment, especially free from conductive dusts. Periodical servicing also depends on the kind of environment in which the DRIVES work as well as ventilation.

To ensure correct servicing follow the check-list to be found at the end of this manual.

Part replacement

Due to the ageing of mechanical and electronic components we suggest replacing :

- FAN T 01 modules every 27500 hours
- FAN T 02 modules every 40000 hours
- FAN T 03 modules every 40000 hours
- Capacitor modules every 5 years (after inspection) if exploited for 50%, 2 years in case of 100% exploitation*
- The capacitor boards inside the system every 5 years (after inspection)
- Fuses every 10 years

Notes on servicing

- Cleaning of metal parts with compressed air 10bar max. (135psi)
- The cleaning of the boards, if necessary, must be carried out by skilled personnel that will use specific solvents for electronic components after check their suitability for plastic parts as well.

NOTE *it is recommended to contact a REEL Service Center.*

- Do not replace electronic components on the boards, even when they look seriously damaged. Always contact a Service Center instead.
- The replacement of fan or capacitor modules having failed shall be carried out according to the instructions contained in the check-list, available on the manual's CD ROM.

* **Exploitation factor** 100% = machine used at full load during every working shift.

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DIAGNOSTICS

The modular drive system by REEL communicates with the outside world through the supply module.

Any status or alarm of a single power module is signalled to the supply unit which takes the info to RS 485 and disables, in case of alarm, a hardware enabling output when programmed for such purpose.

When the SUPPLY module is provided with a programming keypad, a message identifying the alarm appears on the display.

Every single drive informs the supply unit on the own alarm and displays the own status through LEDs.

The number of blinking identifies the kind of alarm or the enable status.

Have the modules no programming keypad, the occurring alarm or the enable status can be identified through the three LEDs on the control board.

Every LED signals:

0 = OFF

1 = ON

2L = (blinking twice+ pause)

3L = (blinking three times +pause)

4L = (blinking 4 times +pause)

II LED 3 differentiates the running from the alarm status :

L3 : 0 -> alarm

L3: 1 -> run

L3: 2L -> ready to start (stand-by)

Is LED3 **off,** then LED1 and LED2 identify the alarm :

LED1	LED2	ALARM
0	0	NULL
0	1	Motor protection
1	0	Power section protection
1	1	Overload
0	2L	Low 24V
2L	0	Max. Voltage
2L	2L	Feedback
0	3L	Overspeed
3L	0	Not encoded
3L	3L	Congruence
0	4L	Thermal switch
4L	0	Communication
4L	4L	Not encoded

Is LED3 on, LED1 and LED2 signal the following functions:.

LED1	**LED2**	**STATUS**
0	0	Not enabled
0	1	EN1
1	0	EN2
1	1	EN2+ EN1
2L	2L	CCW
2L	1	CCW + EN1
1	2L	CCW + EN2
3L	3L	CCW + EN1 + EN2

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LIST OF ALARMS DISPLAYED

MESSAGE ON DISPLAY	DESCRIPTION
Comm	Communication between masters
Comm slave	Communication between two indicated slaves
Bus open	Communication bus is not properly connected between the indicated points
Comm M->Prec.	Communication between master and previous slave
Download param	The master cannot send parameters to the slaves
Bus not config.	Configuration error of one slave at the start-up
Frame error	Frame error
Eeprom not found	System memory not working properly
Invalid conf.	Memory data configuration on supply unit not correct
Conf. mismatch	The tunnel configuration does not correspond to the previously saved one.
Mains failure	Mains Failure on one phase already given at start-up
Slave in alarm	Alarm on one slave (press ENTER for further details)
Min. voltage	Min. supply voltage
Max. voltage	Max. voltage on the DC bus
Killer	Excessive use of the dynamic brake
Brake OFF	Dynamic brake out of service
Brake	Short circuit on the brake output
Thermal probe	Thermal probe of the supply unit
Charge failed	Capacitor charge failure
Thermal prealarm	Thermal warning
Low 24 Volt	Stabilized voltage not sufficient or in overload
Card temperature	Env. temperature >50° C
Boot error FPGA	Configuration error PLD at start-up
Overload	Overload on the indicated slave
Thermal switch	Thermal protection on the indicated slave
Encoder	Encoder error on ind. Slave
Power section protection	Power section protection on ind. Slave
Motor protection	Motor protection on ind. Slave
Min. voltage	Minima tensione dello slave indicato
Max. voltage	Max. voltage on Dc bus
Overcurrent	Overcurrent on the ind. Slave
Congruence	Congruence error on the ind. Slave
Feedback	Feedback error on the ind. Slave

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SERVICE CHECK-LIST WAVE 3 SYSTEM

In order to prepare the system for servicing:

- ❑ Stop the system
- ❑ Cut off the mains
- ❑ Wait for the system to be fully unloaded; LEDs must all be off
- ❑ Wait 5 minutes after the last LED has gone off before removing the protecting covers
- ❑ Use handshoes made of rubber or other insulating material
- ❑ Use shoes having an insulating sole.
- ❑ Use tools with insulating grip

Start checking :

- ❑ Check for the slits on the Power modules to be clean
- ❑ Check for the slits on the Supply module to be clean
- ❑ Check for the ventilation part of the system to be clean in order to avoid duct obstruction.
- ❑ Check also other ducts and slits ensuring the correct air circulating within the system
- ❑ Check for the ventilation inside the FAN module to avoid possible trouble due to bearings .
- ❑ Check for the power terminal boards of the mains or motor to be fixed properly
- ❑ Check for the screws to be properly tightened
- ❑ Check for humidity inside the cabinet housing the system
- ❑ Check for darkened or burnt or faded wires, especially near the clampings of the power part.
- ❑ Check for the capacitors not to show any swelling on their upper part
- ❑ Check for liquids / smell coming from the system, especially from the capacitor modules.
- ❑ Check the fixing of the metal bearings
- ❑ Replace detective parts when needed .
- ❑ Close the cabinet's door and start the system by following the indications contained in charter " starting the system"

Person in charge…….. **date** ……

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CHECK-LIST FOR MECHANICAL REPLACEMENT OF A WAVE 3 MODULE

How to disassemble the unit:

- ❑ Disconnect the supply voltage

  After disconnecting wait at least 10 minutes before working on the tunnel

  NOTE ***REEL SRL is not responsible for any damage to persons or things in case the rule should not have been respected (The warning is printed on the unit in English:*** *"WARNING! After switching off the mains voltage, wait for at least 10 minutes before opening the protection"*

- ❑ Disconnect the module's output connections with a screwdriver (for modules with screw terminals).

  In case of modules with screw bolts, disconnect the motor connections as follows:

  - Remove the protection on the module's right side ;
  - Disconnect using a wrench size 10

- ❑ Remove the protecting cover by unscrewing the central screw with a screwdriver.
- ❑ Remove the connectors to the other modules and the external electromechanical parts .
- ❑ Remove the left protection of the dc bus.
- ❑ Unscrew the dc bus' screws with a wrench size 10 .
- ❑ Unscrew the fixing screws between the modules using a screwdriver. Unscrew the tunnel fixing screws on the panel or other supporting structure with a spanner size 10.
- ❑ Take out the module slowly, gently turning it toward the right.
- ❑ Pack the module properly in order to protect is against bumps or dropping.

  NOTE ***do not use melt polystyrene or other small size material which could obstruct the cooling ducts or the fans***

How to re-assemble the unit :

- ❑ Mount the new module gently taking care that the boards are not damaged during the operation.

  NOTE *Should it be difficult to assemble the new module inside the tunnel, more space can be gained by acting as follows:*

  - *Loosen all bolts on the dc bus from the top to the bottom;*
  - ***Loosen all panel fixing bolts of the other modules.***

- ❑ Tighten the screws between the modules with a screwdriver
- ❑ Tighten the dc bus bolts with a wrench size 10 having a 8 Nm load limit
- ❑ Tighten the fixing bolts of the tunnel on the back panel
- ❑ Re-assemble the dc bus' left-side protection carefully.
- ❑ Re-connect the module's output cables by using a proper screwdriver.

For modules with bolt connections act as follows:

- Remove the protection on the module's right side.
- Connect the cables using a wrench size 10 with 8 Nm load limit
- Re-assemble the protection carefully.

- ❑ Re-assemble the connectors .
- ❑ Fix the protection cover again and tighten the central screw.

Person in charge: ……..…….. **Date ……..**