



**CST Wastewater
Solutions**

OPERATION & MAINTENANCE MANUAL

SCREEN EXTRACTOR

MODEL SF 3 x 5.0 mm

Project: Kalbar WWTP

Client: Queensland Urban Utilities

CST Ref: 251540
Year: 2014
Serial No: 18.134.14

CST Wastewater Solutions Pty Ltd
16/20 Barcoo St
Roseville NSW 2069
Australia
Tel: 612 9417 3611
Fax: 612 9417 0097
Email: info@cstwastewater.com
Website: www.cstwastewater.com

I	INDEX	3
0	INTRODUCTION	5
0.1	MANUFACTURER	5
0.2	HOW TO CONSULT AND USE THIS MANUAL	5
0.3	INFORMATION CONTAINED IN THE MANUAL	6
0.4	SYMBOLS USED IN THIS MANUAL	6
1	GENERAL INFORMATION	8
1.1	MACHINE IDENTIFICATION DATA	8
1.2	INFORMATION ON TECHNICAL SUPPORT	8
1.3	INFORMATION ON SUPPLY WARRANTY	9
1.4	GENERAL SAFETY INFORMATION	10
2	INFORMATION ON THE MACHINE	11
2.1	MACHINE DESCRIPTION	11
2.2	DIMENSIONS	11
2.3	INTENDED USE	12
2.4	OPERATING LOGIC	12
3	TRANSPORT, LIFTING AND HANDLING	14
3.1	RECEIVING THE MACHINE	14
3.2	TRANSPORT AND HANDLING OF THE PACKAGED MACHINE	14
4	INSTALLATION	16
4.1	PRELIMINARY OPERATION	16
4.2	INSTALLATION	16
4.3	ELECTRICAL CONNECTIONS	17
4.4	WATER CONNECTIONS	19
5	USE OF THE MACHINE	20
5.1	PRELIMINARY OPERATIONS FOR STARTING UP THE MACHINE	20
5.2	PREVENTIVE MEASURES DURING START-UP	21
5.3	INSTALLED SAFETY MEASURES	21
5.4	OTHER RISKS	22
6	MAINTENANCE	23
6.1	ORDINARY MAINTENANCE	23
6.1.1	CLEANING	23
6.1.2	CHECKS MADE BY THE MANUFACTURER	23
6.1.3	INSPECTION 10 HOURS AFTER INSTALLATION	23
6.1.4	PERIODICAL CHECKS	24
6.2	NON-ROUTINE MAINTENANCE	25
6.2.1	REPLACEMENT OF THE CLEANING BRUSHES	25
6.2.2	REPLACEMENT OF THE SCREEN BASKET	26
6.2.3	REPLACEMENT OF THE LATERAL FLAPS ON THE BASKET	27
6.2.4	REPLACEMENT OF THE WEARING BARS IN THE CONE	28
6.2.5	REPLACEMENT OF THE WEARING BARS IN THE TUBE	31
7	TROUBLESHOOTING	33
7.1	DIAGNOSTICS TABLE	33
8	RESIDUAL RISK ANALYSES	34
8.1	MECHANICAL RISK	34
8.2	ELECTRICAL RISK	35
8.3	THERMAL RISK	35
8.4	RISK ASSOCIATED WITH THE EMISSION OF NOISE FROM THE MACHINE	36
8.5	RISK ASSOCIATED WITH THE VIBRATION OF THE MACHINE	36
8.6	RISK ASSOCIATED WITH THE EMISSION OF RADIATION	36

8.7	RISK ASSOCIATED WITH THE MATERIAL PROCESSED OR DISCHARGED BY THE MACHINE	37
8.8	RISK ASSOCIATED WITH THE NON-COMPLIANCE WITH ERGONOMICS	37
8.9	RISK ASSOCIATED WITH THE COMBINATION OF SEVERAL TYPES OF DANGER	38
8.10	RISK ASSOCIATED WITH THE FAILURE IN THE SUPPLY OF ENERGY, BREAKAGE OF MACHINE PARTS AND OTHER MALFUNCTIONS.....	38
8.11	RISK ASSOCIATED WITH THE (TEMPORARY) ABSENCE AND/OR INCORRECT PLACEMENT OF SAFETY MEASURES/INSTRUMENTS.....	39
8.12	RISK ASSOCIATED WITH THE MACHINE MOBILITY	39
8.13	RISK ASSOCIATED WITH LIFTING	40
8.14	RISK ASSOCIATED WITH LIFTING PERSONNEL	40
8.15	RISK ASSOCIATED WITH UNDERGROUND WORK.....	40
9	ADDITIONAL INSTRUCTIONS	41
9.1	WASTE DISPOSAL	41
9.2	MACHINE DECOMMISSIONING AND DEMOLITION.....	41
9.3	DIRECTIONS FOR EMERGENCY SITUATIONS	42
9.4	RETURNING THE MACHINE TO THE MANUFACTURER	42
9.5	LONG STORAGE TIME	42

ATTACHMENTS**1 DRAWING & SPECIFICATION**

- SF3 GA Drawing 251540; 134.14 Rev 00
- Technical Specification Screen Extractor SF 3

2 SPARE PARTS LIST

- Table & Diagram

3 CONTROL PANEL

- Electrical Layout Drawing 14117-3
- Electrical Control Drawing 14117-2
- Electrical Single Line/Equipment Drawing 14117-1
- Functional Description
- Horner HE – XE 102
- Emotron-F1 M10 Shaft Power Monitor
- Endress + Hauser FMU-30 Level Transmitter

4 MOTOR/GEARBOX DETAILS

- Rossi Gear Motor

5 LONGOPAC BAGGING UNIT

0 INTRODUCTION

0.1 MANUFACTURER

CST Wastewater Solutions Pty Ltd

16/20 Barcoo St

Roseville NSW 2069

Australia

Tel: 612 9417 3611

Fax: 612 9417 0097

Email: info@cstechnology.com.auWebsite: www.cstwastewater.com

0.2 HOW TO CONSULT AND USE THIS MANUAL

This use and maintenance manual is written referring to **Machinery Directive EC/98/37**; it forms an integral part of the supply of the machine.

It contains all the information necessary for the operation and maintenance of equipment provided by the manufacturer, in addition to this, instructions for proper use to ensure the safety of on-site personnel, whether used singularly or in a wider context (plant).

The manufacturer reserves the right to make changes to the manual at anytime. Changes do not require prior warning. This manual is correlated, depending on the supply, with attached documents to complete the machinery supply (certificate of conformity - test certificate - other attachments).



THE USER OF THE MACHINE MUST READ THIS MANUAL AND ATTACHED DOCUMENTATION IN WHOLE PRIOR TO USE

The Manufacturer is not liable for actions that the customer undertakes with this machine in the event of non-compliance with the safety standards mentioned here and described in the **European Machinery Directive**.

Do not damage this manual or its contents in any way.

Do not remove, tear out or rewrite any part of this manual for any reason whatsoever.

Store this manual in a safe and clean place, protected against humidity and heat.



This document must always be available for any consultation, if necessary.

In the event the manual is lost, ruined or torn, please contact our Technical-Commercial Dept to request a copy.

0.3 INFORMATION CONTAINED IN THE MANUAL






This manual contains all instructions relating to the technical features of the machine, all the information and data necessary for its proper use and installation. The user must follow the directions stated.

The manual has been written in accordance to the EEC regulations regarding technical documentation “EN 292-2”, for the integrity of the machine and ensuring the safety personnel involved in its use.

The information on the maintenance of the equipment must be followed and implemented by qualified staff specialized in the installation and maintenance of the equipment used at the worksite or industrial plants and/or municipal water treatment.

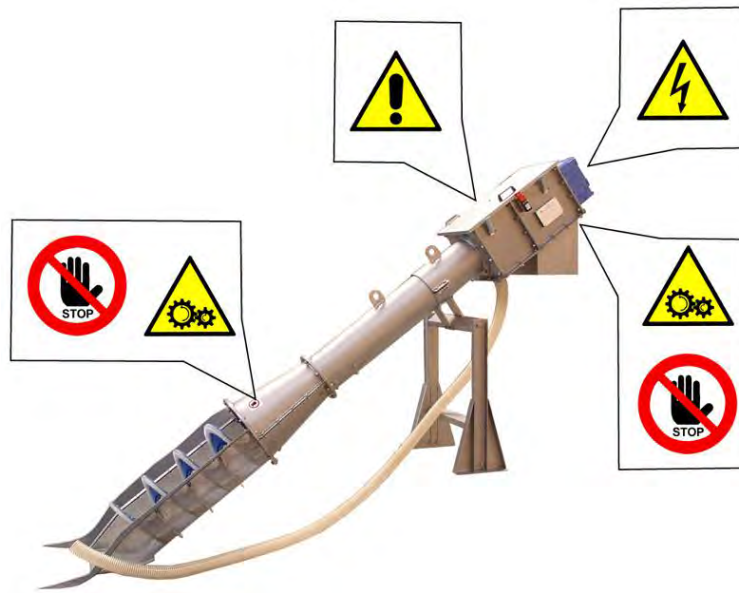
0.4 SYMBOLS USED IN THIS MANUAL

The following **SYMBOLS** are used throughout this publication to call the user's attention to which actions should be taken during each operating situation.

Symbol	Description
	Read the note carefully
	GENERIC DANGEROUS SITUATION A supplementary note will indicate the type of danger.
	RISK OF ELECTRICAL SHOCK Exercise the greatest caution before carrying out any machine intervention. Power supply MUST be cutoff.
	DANGER: MOVING COMPONENTS Exercise the greatest caution before carrying out any machine intervention. Power supply MUST be cutoff.
	NO ACCESS TO THIS ZONE The specific zone MAY NOT be accessed while the machine is running. Exercise the greatest caution before carrying out any machine intervention. Power supply MUST be cutoff.

Indicated below is where the foregoing symbols are located on the machine.

Figure 1 – Position of safety pictograms



Should the foregoing symbol-plates fade, wear out or become illegible over time, the user must replace them with new ones having the same characteristics.

The absence of these plates, their illegibility or non-compliance might lead to serious hazards for the operator.

1 GENERAL INFORMATION

1.1 MACHINE IDENTIFICATION DATA

The data identifying the machine and its manufacturer are shown on a metal plate area called the “identification plate”; the metal plate must be applied to the machine on one side of it so that it is clearly visible. The data are as follows:

- name of the manufacturer of the machine, address, telephone and fax numbers;
- CE – mark of conformity;
- model of the machine;
- serial number;
- year of manufacture of the machine.

Figure 2 – Identification plate

MODEL :	
SERIAL No :	
YEAR:	

CST Wastewater Solutions Pty Ltd
 16/20 Barcoo St. Roseville NSW 2069 Australia
 Ph: 61 2 9417 3611 Fax: 61 2 9417 0097
 Email: info@cstwastewater.com
 Web: www.cstwastewater.com

The nameplate must be kept in good condition; it must not be damaged or removed. If necessary, the user must contact the manufacturer to obtain a replacement and return the damaged identification plate (in accordance with those directives described in the current **Machinery Directive 98/37 CE: Machine and Manufacturer Identification Material**).

1.2 INFORMATION ON TECHNICAL SUPPORT

In order to obtain the best performance from the machine and to avoid problems that could lead to voiding the warranty, all that which is stated in this manual must always be closely adhered to.

This use and maintenance manual is an integral part of the machine and must be easy to access by all personnel in charge of running the machine.

Should you wish to contact the After Sales Technical Support, after having carefully read this manual, have at hand the manual in order to be able to refer to it to better understand the nature of your problem.

When calling the After Sales Technical Support, always state the model and serial number of your machine, both of which are indicated on the plate fixed to the machine.

1.3 INFORMATION ON SUPPLY WARRANTY

The manufacturer provides the machine user with the following warranties:

- **Guarantee of validity of the documentation throughout the life of the machine (can be modified by the manufacturer at any moment);**
- **Warranties linked to the machine supply.**

This Manual is meant for the personnel who will use and operate the machine which is the object of the supply. The operator must read the documentation (including attachments, if present) in order to carry out all the operations on the machine correctly and safely, including:

- various ordinary and/or extraordinary maintenance operations;
- assembly/disassembly operations on machine parts (first installation, spare parts replacement);
- extraordinary maintenance during normal machine operation.



The documentation can be modified by the manufacturer at any moment without obligation to inform the machine user.

As regards the warranties linked to the machine, remember that the recommended duration of use depends on the conditions and material for which the machine is meant. This information can be obtained by contacting our Technical - Commercial Dept. The warranty conditions will not be valid in the case of failure to respect the following instructions for use:

- **use the machine correctly according to the indications given here;**
- **operate appropriately during maintenance;**
- **constantly check parts subject to wear; these must be replaced before they are completely worn, as they can cause serious mechanical, tank and structural damage to the machine. In this condition, safety of personnel may also be jeopardized.**

The customer must remember that the warranty on the supply only covers the machines in case of mechanical defects or defects in assembly if carried out by Manufacturer or the manufacturer's trusted assembly personnel. The warranty is invalidated in case of:

- *Improper use of the machine;*
- **Use of the machine by unskilled personnel not qualified for the tasks to be performed by the machine;**
- **Use not conforming to the standards applicable in the matter;**
- **Defects in installation of the machine components;**
- **Incorrect electrical and water connections of the various parts of the machine;**
- **Incorrect maintenance operations not conforming to the indications in this manual;**
- **Use of spare parts that are not genuine;**
- **Transport, lifting and handling operations without using suitable means.**

1.4

GENERAL SAFETY INFORMATION



The operations outlined in this manual were written to assist the operator when using and servicing the machine.

1. DO NOT TOUCH MOVING PARTS

Keep your hands, fingers and other body parts away from moving parts.

2. DO NOT USE THE MACHINE UNLESS THE GUARDS HAVE BEEN INSTALLED

All machine safety guards, provided by the manufacturer, must always be perfectly installed.

Should you need to remove one or more guards for maintenance purposes, be sure to refit them before using the machine again.

The machine must be OFF during maintenance.

3. WORK CLOTHES

Wear suitable clothing when using the machine.

4. DO NOT USE THE MACHINE IF FAULTY

If the machine makes anomalous noise, vibrates too much or appears defective in any way while running, stop it immediately and check what is causing the problem or fault.

5. USING THE MACHINE

All personnel must be properly informed about how to operate the machine before beginning work.



Store this Use and Maintenance Manual in a suitable place and ensure the personnel using the machine have access to it at all times.

2 INFORMATION ON THE MACHINE

2.1 MACHINE DESCRIPTION

The Screen Extractor/Compactor is a machine developed to screen any kind of effluent and to transport the screenings out from the liquid.

Different models are manufactured depending on the installation and/or application.

Depending on the installation the machine can be supplied:

- **Without tank:** INSTALLATION IN A CHANNEL
- **With self standing tank:** DIRECT CONNECTION TO A PIPE

Depending on the application the machine can be supplied:

- **Without compacting zone:** TO DISCHARGE THE SCREENINGS INTO A BIN
- **With compacting zone:** TO COMPACT/DEWATER THE SCREENINGS BEFORE THE DISCHARGING INTO A BIN.

The models are:

SF: Screen Extractor for channel installation, without compacting zone.

SF/T: Screen Extractor with self standing tank, without compacting zone.

SFC: Screen Compactor for channel installation, with compacting zone.

SFC/T: Screen Compactor with self standing tank, with compacting zone.

2.2 DIMENSIONS

Dimensional data are indicated in the Layout enclosed with this documentation.

WEIGHT TABLE in kg (for standard unit)

Model	2	3	4	5	6	7
SF	400	420	450	500	590	640
SFC	420	430	470	520	610	660
SF/T	490	520	550	600	720	780
SFC/T	500	530	570	620	740	800



For special machines, refer to the Layout enclosed with this documentation.

2.3 INTENDED USE

The machine and its equipment are to be used exclusively for the purposes for which they have been designed and built.

ANY OTHER USE NOT CONTEMPLATED BY THE USES SPECIFIED HEREIN, WILL RELIEVE THE MANUFACTURER OF ANY RISKS THAT COULD ARISE.

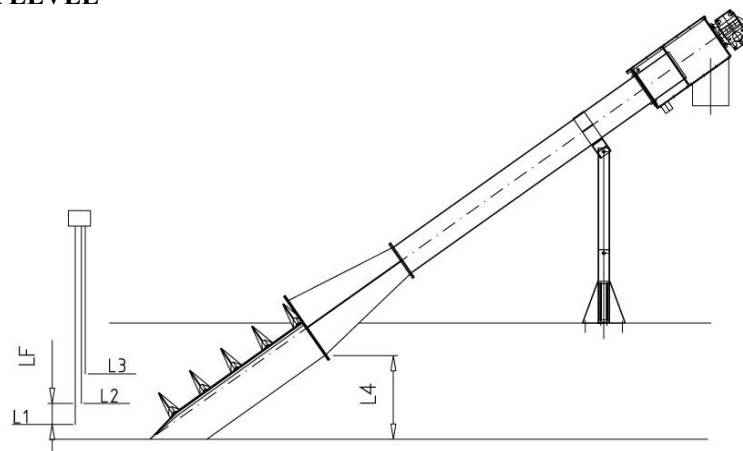
In any case, using the machine other than in the way agreed upon when purchased will **RELIEVE THE MANUFACTURER OF ANY RESPONSIBILITY FOR DAMAGE/INJURY TO THE MACHINE/PROPERTY/PEOPLE.**

2.4 OPERATING LOGIC

SFC-SF SCREEN COMPACTOR

WATER LEVEL

Figure 3 – Water levels diagram



	SF-SFC-TYPE				
	SF-SFC2.3	SF-SFC 4	SF-SFC 5	SF-SFC 6	SF-SFC 7
L1	X	X	X	X	X
L2	XX	XX	XX	XX	XX
L3	400	430	540	660	770
L4	440	460	570	680	800
LF	150	180	290	400	500

L₁ = Level of Contact. At this level the spiral is off: there is the presence of water in the basket. It can be considered as the common contact.

L₂ = level of Spiral Rotation.

L₃ = level of Alarm.

L₄ = maximum Level.

CONTROL PANEL RUNNING LOGIC

The level inside the basket rises upon blockages due to solid wastes. Once level **L₂** is reached, a timer is initiated (for 2-30 minutes). After a few seconds, the spiral is launched.

At the end of the timer count down, if the water is still higher than level **L₂**, the timer will restart and the spiral will continue to rotate.

If the water level, after the time, does not reach the level **L₂** start-up, the spiral is stopped.

If the water level reaches alarm level **L₃**, the timer will not work and the spiral will keep turning. A visual alarm or a buzzer will issue a warning to check the system.

If the water level is below level L_1 contact, the spiral is shut down.



- The timer allows the installation to avoid frequent starts because of foam, etc.
- In order to improve the ability to clean the brushes, it is necessary to engage the spiral in reverse rotation for a few seconds at the end of each working cycle.
- It is advised to install a torque limiter as an electronic security system. In case of the blocking of the spiral, the system should be stopped and started in the reverse direction of rotation for a few seconds.
- Subsequently, the spiral should then be launched again in the correct direction of rotation.
- For reference only: $L_2 = 2/3$ of L_4 . In practice, everything depends on the channel, the maximum admissible water level in the channel, etc.
- $L_1 = 100-150$ mm on the front side of the machine at the bottom of the channel.

3 TRANSPORT, LIFTING AND HANDLING

3.1 RECEIVING THE MACHINE

On receiving the machine, the user must carry out a series of checks to:

- check the number of packages delivered and verify this on the transport documentation;
- check the condition of the machine and the equipment;
- check the machine for visible damage.

If there is a discrepancy between the packages delivered or their contents and the transport, inform the haulage contractor and then contact our Technical - Commercial Dept.

In case of damage or missing parts, inform the shipping agents immediately in detail and notify Manufacturer. Prompt notification is necessary to ensure that the manufacturer can supply or replace the machine parts.

On receiving the goods, check for the presence and condition of:

- The Instruction Manual;
- CE Declaration of Conformity;
- Machine identification plate.

After receiving the machine, the customer must prepare the installation area for positioning all the electrical and water connections.

3.2 TRANSPORT AND HANDLING OF THE PACKAGED MACHINE



Only qualified personnel are allowed to handle the packed machine, using suitable equipment.

Before handling the machine in any way, ensure that the load-bearing capacity of the hoist is suitable for the load to be lifted. Fix the lifting chains to the eyebolts and lift the machine slowly, avoiding sudden movements.

Figure 4 – Lifting eyebolts

Do not linger in the operating area for any reason whatsoever and do not climb on top of the crate/machine when handling it.

Load the machine onto wooden boards or pallets of suitable thickness and never allow the machine to touch the floor.

4 INSTALLATION

4.1 PRELIMINARY OPERATION

All machines manufactured before the first shipment are submitted to a series of checks (blank test-vacuum test) to ensure the machine is without flaws of any kind. These defects, if any, could affect the operation of the machine and cause danger to the staff involved. The checks that the manufacturer performs are conducted in accordance with the Community Legislation on Safety.

Machinery must be positioned in such a way as to ensure adequate space around the machine necessary for the passage and operation by staff (controls, assembly/disassembly, and maintenance).

4.2 INSTALLATION

Prepare the installation area with a concrete plan surface suitable for the dimension and weight of the machine.

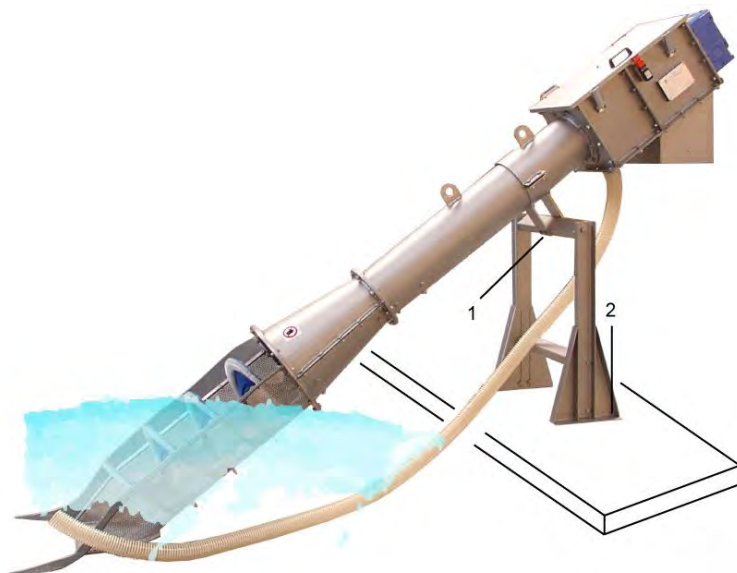
All the operations outlined below are at the full care and expense of the end customer who must comply with the relevant rules and regulations to ensure the safety of the entire machine and the personnel in charge of said machine.

Use suitable equipment to handle and lift the machine and its parts, which were shipped unassembled for space-saving purposes.

If wooden wedges, iron wires or other means have been used during transport, remove these before installing the machine.

1. Put the machine in position inside the channel at the right inclination.
2. Position the lower part of the support B under the machine.
3. Fix the lower part to the upper part of the support A by means of the screw [1].
4. If it is necessary, adjust the height of the support.
5. Anchor the support to the floor using suitable nuts and bolts [2].

Figure 5 – Installation in the channel



After having positioned and anchored the machine, make all the relevant hydraulic and electrical connections.

4.3 ELECTRICAL CONNECTIONS

The machine is equipped with all the standard electrical components required to run the electrical motor.

The machine user is responsible for setting up the installation area with all the safety precautions necessary concerning the electricity network. They are also responsible for providing all the electrical connections for the drive units.



The machine's electrical connection, which is at the customer's care, must be carried out by qualified personnel. They should always use suitable equipment.

While making the connections, the user must take into consideration the environmental conditions of the machine installation area; the machine may be installed in closed or open areas.

The user must operate in accordance with the standards applicable in the country in which the machine is installed.



ALL OPERATIONS ON THE MACHINE MUST BE CARRIED OUT WITH THE ELECTRICITY DISCONNECTED.

Before starting up the machine, the user must carry out certain checks to avoid damage.

The mains voltage must be checked to make sure it corresponds to that required for the drive unit; the cross check must be done by checking the drive unit rating plate.

STANDARD, ONE SPEED, ELECTRICAL MOTOR CONNECTION

Figure 6 – Triangle connection

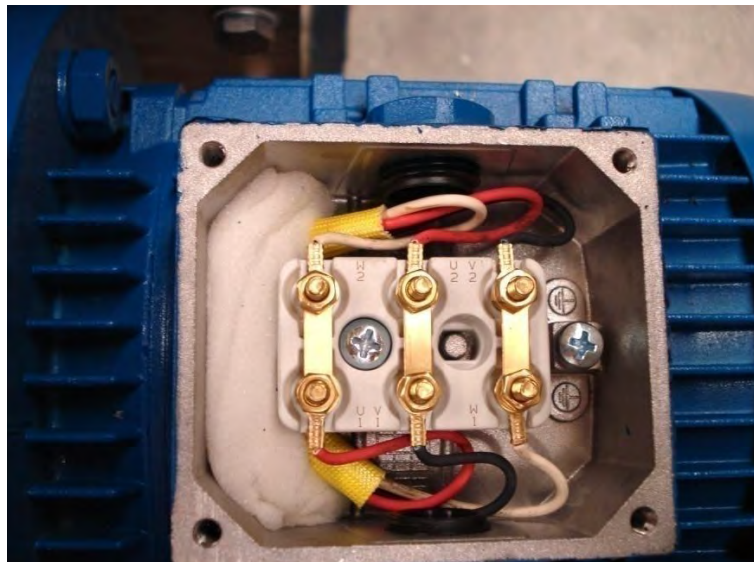
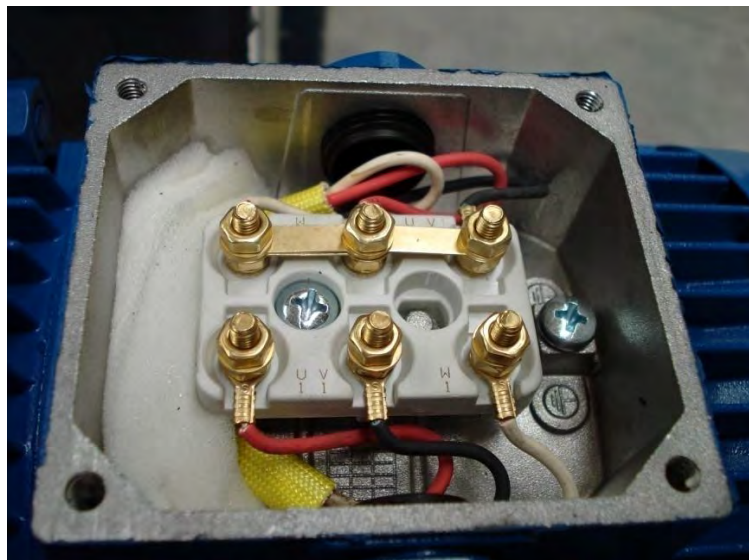


Figure 7 – Star connection

Also check the direction of the spiral's rotation as indicated by the arrow on the drive unit; operation in the opposite direction will lead to MALFUNCTION and possible DAMAGE.

Figure 8 – Rotating direction

MAKE THE CONNECTIONS ENSURING THAT THE ELECTRICAL COMPONENTS NEVER COME INTO CONTACT WITH THE WATER OF THE MACHINE'S CLEANING SYSTEM.

4.4 WATER CONNECTIONS

STANDARD VERSION MACHINE (see figure 9)

In the standard version there are the following water connections for the daily manual cleaning of the machine:

- [A] – ½" manual valve water inlet clean or service water. To wash the compacting drum (ONLY on SFC SFC/T model).

Figure 9 – Water connections



The washing system is made by N° 6 nozzles (Model SF 5) . The water consumption in l/min, depending on the water pressure, is:

1 bar	2 bar	3 bar	4 bar	5 bar	6 bar
20.2	25.3	30.8	35.3	39.3	42.9

- **TO AVOID BLOCKAGES IN THE NOZZLES USE 80 MESH FILTRATION FOR THE WASHING WATER**
- **TYPICAL WORKING PRESSURE 2/3 bar.**

5 USE OF THE MACHINE

5.1 PRELIMINARY OPERATIONS FOR STARTING UP THE MACHINE

While starting up the machine, the operators trained for working on the machine must check the following:

- that the machine and its various components have not been damaged during transport, assembly and installation;
- that all plates (identification and drive unit rating) are intact;
- that all the documentation included in the supply is present and intact;
- that all electrical and water connections are made correctly;
- the machine supply voltage is correct;
- the terminal box of the motor are perfectly sealed and are not damaged;
- the correct water system supply, by checking the inlet water supply flow;
- ensure that the direction of rotation of the spiral is correct;
- that all the bolts fixing the machine to the supports are tightened firmly;
- that all the parts of the machine are fixed firmly;
- the cover of the compacting zone is closed;
- that the machine is correctly positioned and firmly anchored to the ground
- that the safety standards concerning functioning of the machine are respected;
- the workers are familiar with all the contents of this manual before working on the machine;
- that all the guards are installed near the loading and unloading areas;
- the presence of warning and hazard notices;
- there are no foreign substances or bulky particles inside the screen basket and the tube that can could damage the machine

These checks must be carried out every time the machine is stopped and restarted after a shutdown exceeding one week.



When first starting the machine, check that it does not emit noises or excessive vibrations, as these are a sign of malfunctioning. In such a case, stop the machine, detach the electrical connections and contact our technical office.

5.2 PREVENTIVE MEASURES DURING START-UP

When first starting the machine, check that it does not emit noises or excessive vibrations, as these are a sign of malfunctioning. In such a case, stop the machine, detach the electrical connections and contact our technical office.

- **It is forbidden to wear rings, wrist watches, necklaces, loose flowing clothing or hanging parts like ties, torn clothing, scarves, unbuttoned or unzipped jackets which can get trapped in moving parts;**
- **It is compulsory to use personal protective equipment such as hard hats, anti-slip footwear, ear muffs, safety goggles, gloves, masks;**
- **Consult your employer regarding the safety standards applicable and the safety devices.**

5.3 INSTALLED SAFETY MEASURES

The machine supplied to you is fitted with a cover on the unloading module that prevents anyone from touching the screw while it works. Other protections may be fitted in zones in which checks and maintenance are performed, to guarantee the machine is used properly and safely at all times.

The points not equipped with protections are as follows:

- the screen's outlet, on the motor side, where the moving screw might be touched.
- the inlet, in the sieve area, where the moving screw might be touched.

For this reason the manufacturer has affixed specific danger signs. The user may also place a no-access sign in the area in front of the unloading area.

Always keep in mind that if this manual is read thoroughly and understood in full, and if qualified personnel use this machine, the foregoing hazardous situations are unlikely to take place.

IN ANY CASE THE CUSTOMER IS IN CHARGE OF FITTING THE PROPER TYPE OF PROTECTIONS AROUND THE MACHINE (GRIDS/HANDRAILS) TO PROTECT THE PERSONNEL RUNNING THE MACHINE.

The customer must constantly ensure, through his/her own staff, that the area around the machine is always clean and free of liquid or oily substances that could endanger the personnel operating the machine.

In addition to the supplied guidelines and directions, please keep in mind that, as concerns the underground models, the machine user must close the area on top of the machine with screens or protective nets or put up a fence around the surrounding area.

5.4 OTHER RISKS

The screen outlet cannot be closed and, as such, the conveying spiral can be reached through this opening.



Never insert your hands, objects, tools, etc. into the outlet. A danger and prohibition sign must be affixed adjacent to the outlet to notify the personnel about this danger.

If the machine is installed in a channel, the ROTARY SPIRAL in the screen area may be reached.



When the machine is installed inside a channel, the screen area must be closed by a cover. If this is not possible, the area must be enclosed by chains and/or no-access signs.

6 MAINTENANCE

6.1 ORDINARY MAINTENANCE

The personnel responsible for the machine's maintenance must be suitably trained and qualified to work in complete safety. The measures described here must be followed strictly. Failure to respect these instructions will free the manufacturer of all responsibility.

All maintenance operations must be carried out with the machine stopped and with the electricity disconnected. The area in which the operators work must always be kept thoroughly clean, free of oil and grease stains (motors, gear reducers).



Before carrying out any type of maintenance, stop the machine and disconnect the electrical users.

6.1.1 CLEANING

During cleaning phases, do not use compressed air sources; use pressurized water jets to prevent large particles from remaining stuck on the machine. This measure must be adopted for those parts which do not have washing systems.

During these operations, do not use naked flames for lighting.

Provided below is a list of checks completed by the manufacturer and periodical checks that need to be conducted by the user to prevent damage to the machine and also prevent the occurrence of emergency situations.

6.1.2 CHECKS MADE BY THE MANUFACTURER

Before delivery, the manufacturer must proceed with a general inspection of the machine and the relative equipment; this involves a no-load test to check the following:

- the electrical system to check the voltage;
- the water system, especially the working of the spray nozzles;
- ensuring the presence and good condition of all the plates on the various machine components (identification plate and alarm plates and drive unit rating plates);
- the locking of the bolts on the entire structure;
- all the packaging and the crate used for shipping the machine;
- the presence of all the documentation necessary to complete the supply.

6.1.3 INSPECTION 10 HOURS AFTER INSTALLATION

Run the following checks after the first ten work hours:

- check the tightening of the bolts and washers;
- check the tightening of the bolts of the whole structure and its supports;
- check the tightening of the bolts of the whole structure and its supports;
- check the level of noise emitted from the gear box unit and the temperature;
- check that the washing and compaction systems (mod. SFC/V only) are functioning perfectly in order to prevent damage to the machine.

6.1.4 PERIODICAL CHECKS

The machine's routine maintenance consists of a series of checks that the user must carry out while the machine is running, always by personnel who are specifically trained in these types of operations.



The schedule suggested for the periodic checks is not final and might change depending on the machine is used and where it is installed.

Should the user notice, during the following check, that certain parts are worn out or irreparably faulty, they are to be replaced as outlined in **Paragraph 6.2**.

Part involved	Operation	8 hours after installation	Every 40 hours	Every 100 hours	Every month	Every year	Every 2 years
Entire structure of the machine including supports and rotation spiral.	Direction of rotation of the spiral, structure stability and perfect covers locking.	X		X			
Anti-Wear Plates	Clamping bolts.	X		X			
Safety Measures - identifying problems	Presence and integrity.	X		X			
Screen and Brushes	Perfect filtration and correct tightening of the brushes.	X		X			
Flexible hose return	Check fixing	X		X			
Drainage outlets	Check for absence of clogging material	X					
Washing System (nozzles and pipework)	Working efficiency of cleaning water delivery system		X				
Seals and Anti-Wear Plates	Wear condition				X		
Screen	Cleaning				X		
Entire structure of the machine and anti-wear plates	Tightening of the nuts and bolts and wear condition					X	
Motor	Replace seals and coatings						X

6.2 NON-ROUTINE MAINTENANCE

Beyond maintenance of a routine nature, the machine can need maintenance of a non-routine nature. These operations **MUST** be carried out by qualified and trained personnel; usually for these maintenances you must have proper lifting equipment for the parts you need to move.

Below are details on the replacement of certain parts. When replacing parts, it is necessary to disconnect the electricity and disconnect the connecting flanges of the wastewater pipe input of the filter to the screen. When the unit is stopped, proceed with the non-routine maintenance as specified by the manufacturer.

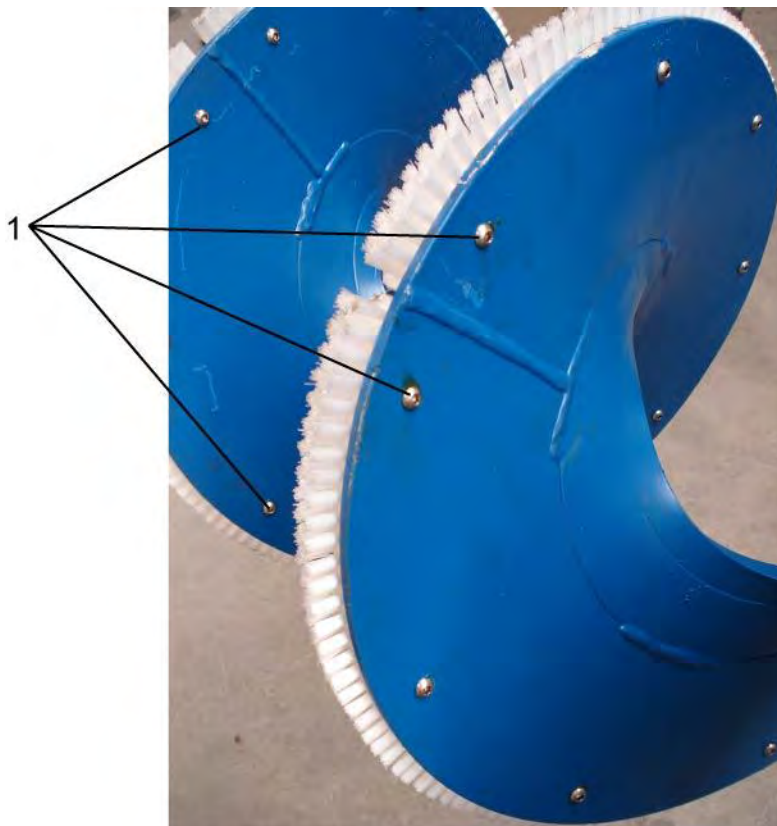


Before carrying out any type of maintenance, stop the machine and disconnect the electrical users.

6.2.1 REPLACEMENT OF THE CLEANING BRUSHES

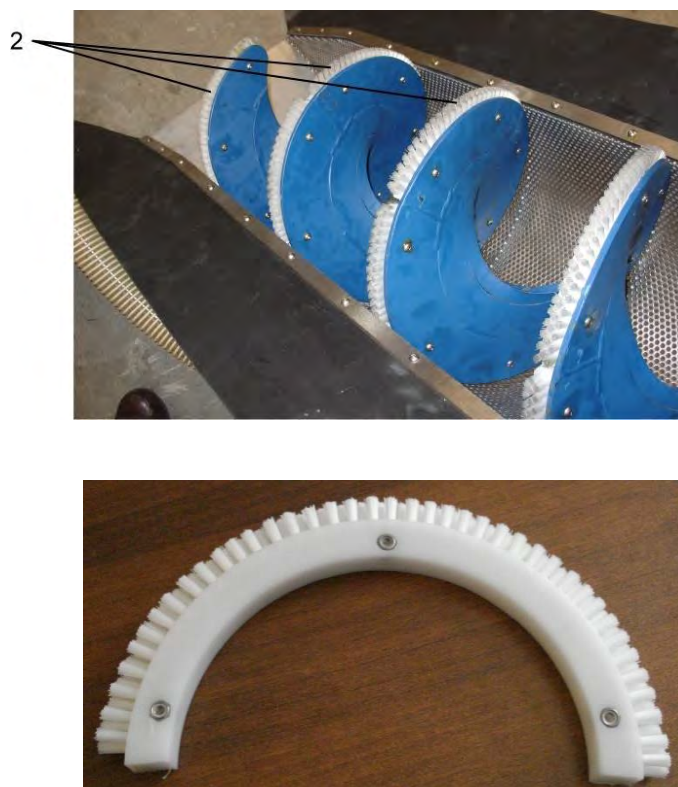
- Move the machine away from its work position.
- Unscrew the screws [1].

Figure 10 – Replacing the brushes



- Replace the brushes [2] and secure them with new screws.

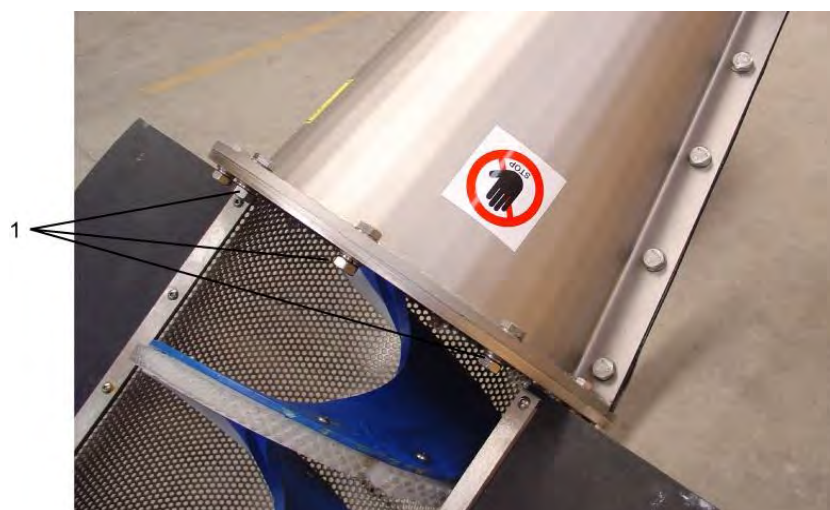
Figure 11 – Replacing the brushes



6.2.2 REPLACEMENT OF THE SCREEN BASKET

- Move the machine away from its work position.
- Unscrew the bolts [1].

Figure 12 – Replacing the screen basket



- Put on the new screen basket [2] and fix it to the cone.

Figure 13 – Replacing the screen basket



6.2.3 REPLACEMENT OF THE LATERAL FLAPS ON THE BASKET

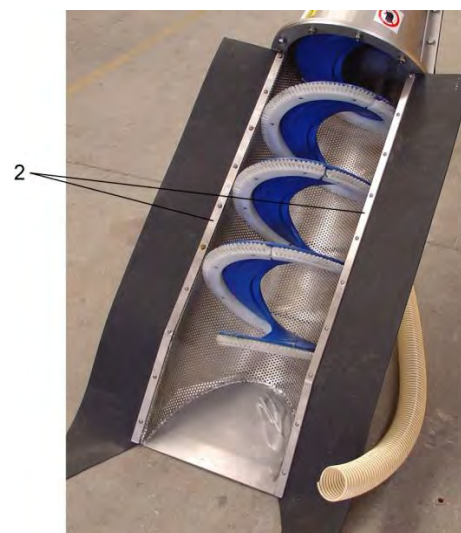
- Move the machine away from its work position.
- Unscrew the screws [1].

Figure 14 – Replacing the lateral flaps



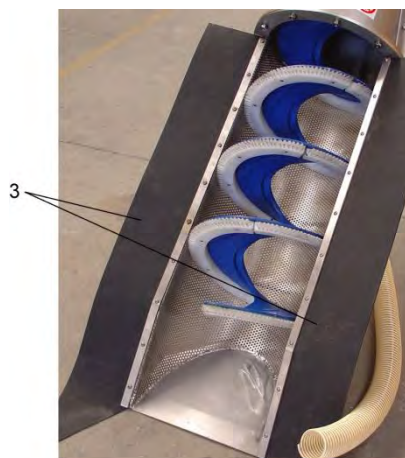
- Remove the fixing flat [2].

Figure 15 – Replacing the lateral flaps



- Remove the rubber flaps [3].
- Fixing: new rubber flaps, the flat and fix all by means of the screws.

Figure 16 – Replacing the lateral flaps



6.2.4

REPLACEMENT OF THE WEARING BARS IN THE CONE

- Move the machine away from its work position.
- Remove the screws [1] fixing the upper part of the cone.

Figure 17 – Replacing the anti-wear plates of the cone



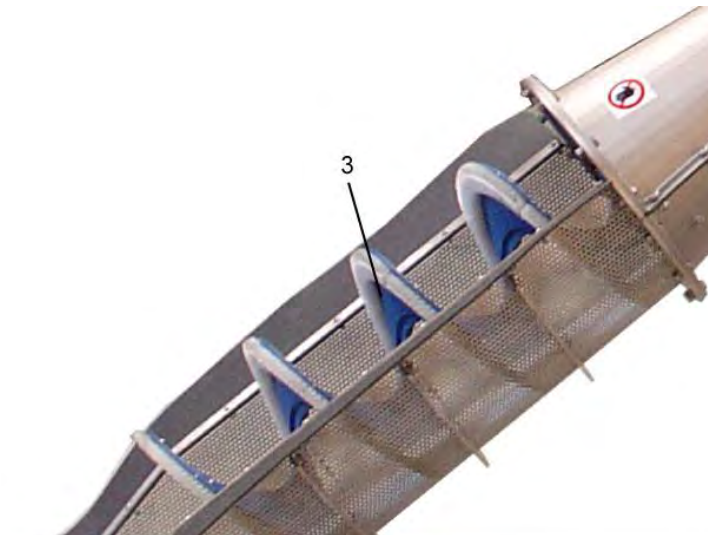
- Remove the upper part of the cone [2].

Figure 18 – Replacing the anti-wear plates of the cone



- Lift up the spiral a little [3] blocking it in position.

Figure 19 – Replacing the anti-wear plates of the cone



- Remove the screws [4] fixing the wearing bars to the cone.

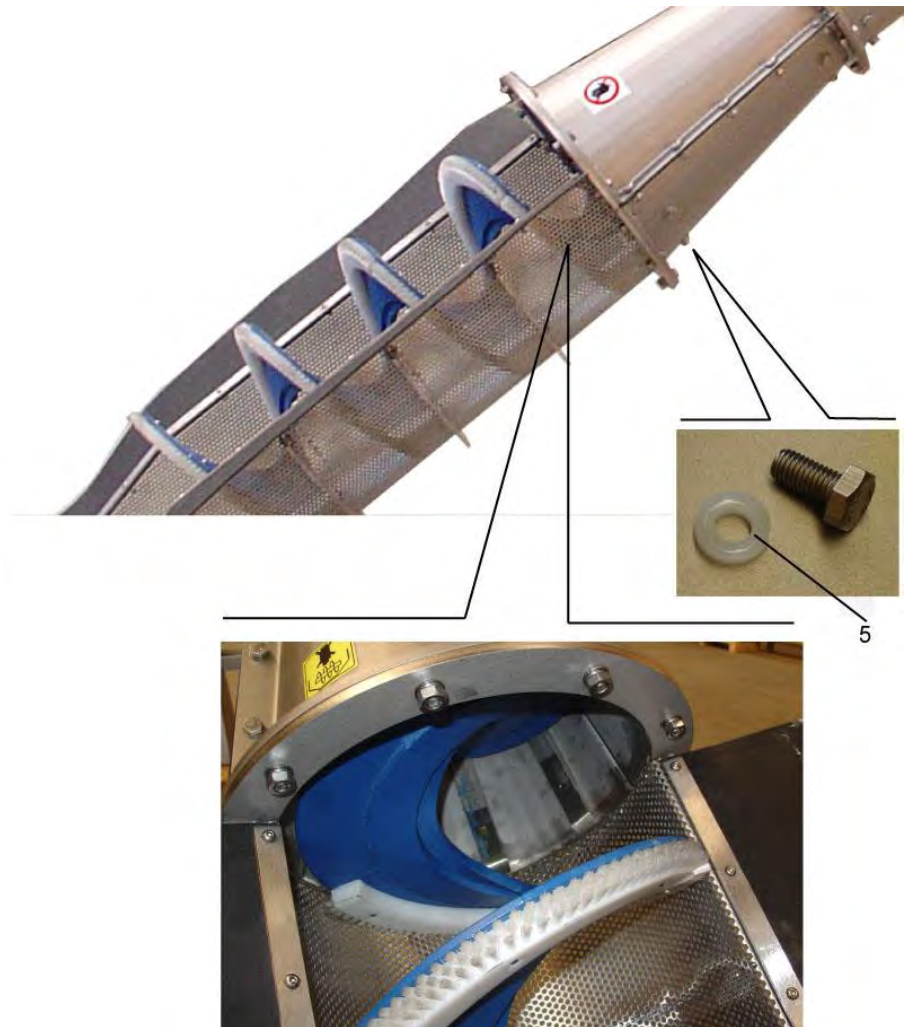
Figure 20 – Replacing the anti-wear plates of the cone



- Remove the wearing bars from the cone.

- Repeat the above operation in reverse order, replacing the special gaskets [5] with new ones.
- Remove the tool used to block the spiral.

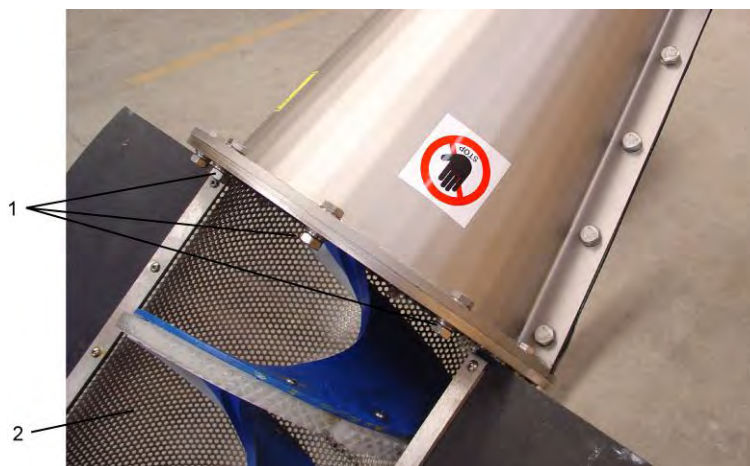
Figure 21 – Replacing the anti-wear plates of the cone



6.2.5 REPLACEMENT OF THE WEARING BARS IN THE TUBE

- Move the machine away from its work position.
- Remove the screws [1] fixing the screen basket [2] and remove it.

Figure 22 – Replacing the anti-wear plates of the pipe



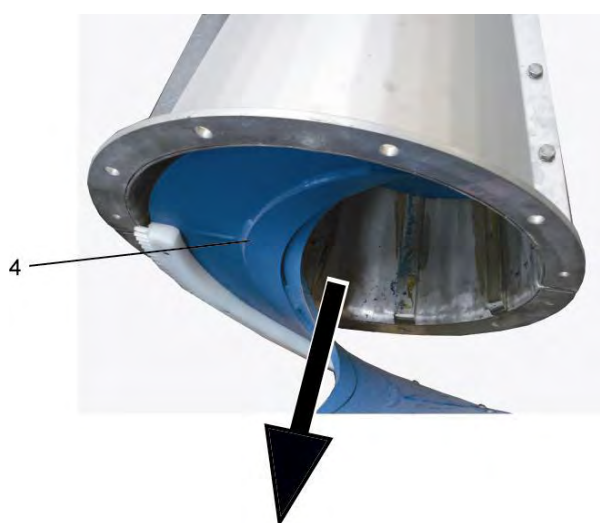
- Remove the screws [3] from the driving flange.

Figure 23 – Replacing the anti-wear plates of the pipe



- Take off the spiral [4] from the tube.

Figure 24 – Replacing the anti-wear plates of the pipe



- Unscrew the screws [5] and remove the cone [6].

Figure 25 – Replacing the anti-wear plates of the pipe



- Unscrew the bolts [7] that fix the anti-wear plates to the pipe.

Figure 26 – Replacing the anti-wear plates of the pipe



- Remove the anti-wear plates from the pipe.
- Repeat the above operation in reverse order, replacing the special gaskets [8] with new ones.

Figure 27 – Replacing the anti-wear plates of the pipe



7 TROUBLESHOOTING

7.1 DIAGNOSTICS TABLE

Pos.	Found problem	Found problem	Resolution
1	STRONG VIBRATIONS IN THE MACHINE DURING THE NO LOAD TEST	Misalignment of the components of the machine connected by means of bolted flanges. Inside the moving parts (spiral) are foreign objects that prevent the proper rotation.	Make sure that the nuts and bolts of all points of attachment are fastened and that all pieces are properly aligned. Remove all foreign objects.
2	HIGH CURRENT DRAW CONSUMPTION DURING THE NO LOAD TEST	A higher voltage than expected is being input into the machine.	Restore the correct voltage.
3	THE MOTOR OF THE MACHINE IS NOT ROTATING	An incorrect voltage is being input into the machine. No electrical input. No electrical input.	Restore the correct voltage. Restore electrical connection. Calibrate the safety switch correctly.
4	THE MOTOR OF THE MACHINE IS NOT ROTATING	The presence of large foreign objects clogging the machine. The effluent input is higher than that which is permitted. The effluent that is being treated contains too many solids, or solids that are too large, causing obstruction in the rotation of the spiral. The spiral is not working and therefore, not lifting the screened material.	Stop the machine and clean the inside of the screen basket. The spiral is not working and therefore, not lifting the screened material. It is necessary to solve this problem before the inlet of the machine. Contact our technical office if problem persists. Check the motor is switched on and working properly.
5	THE SPIRAL IS NOT LIFTING SOLIDS PROPERLY	The incoming effluent does not contain suitable materials to extract. The spiral is rotating in the wrong direction. The spiral is blocked.	This is a temporary problem; wait for effluent with solids that are suitable to be extracted. Reverse two phases in the connecting box of the electrical motor. Remove foreign objects causing blockage.

8 RESIDUAL RISK ANALYSES

8.1 MECHANICAL RISK

	RISKS	RESIDUAL RISK ANALYSES		POSSIBILITY OF RESIDUAL RISKS	REFERENCE TOPIC
1.1	Crushing Hazard	Ref. Extracted from EN414 : - EN 292-1 - EN 292-2	The machine is completely sealed. It is equipped with caution and danger signs which signify any compaction areas. Other possible danger zones are to be marked with the appropriate signs supplied by the customer.	No residual risk present	Topic of Ref. Par. 0.4 - 2.3 – 5.2 – 5.3-5.4
1.2	Shearing Hazard				
1.3	Cutting or Sectioning hazard				
1.4	Danger of entanglement				
1.5	Danger of being dragged or trapped				
1.6	Knocking Hazard		There are no safety measures to adopt here because these are not problems associated with the machine		
1.7	Perforation or puncture hazard				
1.8	Friction or abrasion hazard				
1.9	Danger of the release of high pressure fluids				
1.10	Danger of falling projected parts (of the machine and materials/articles being processed)				
1.11	Loss of stability (from the machine and parts of the machine)	Ref. Extracted from EN414 : - EN 292-1 - EN 292-2	The machine MUST be firmly secured to the ground using suitable methods of anchorage	No residual risk present	Topic of Ref. Par. 4.2
1.12	Risk of sliding, stumbling or falling in relation to the machine (due to mechanical equipment)		There are no safety measures to adopt here because these are not problems associated with the machine		

8.2 ELECTRICAL RISK

	RISKS	RESIDUAL RISK ANALYSES		POSSIBILITY OF RESIDUAL RISKS	REFERENCE TOPIC
2.1	Electrical Contact	Ref. Extracted from EN414: - EN 292-1 - EN 292-2	The degree of protection around the IP of the wiring boxes is indicated by the manufacturer. To avoid any electrical problems, have the electrical connections installed by qualified personnel	No residual risk present	Topic Ref. Phar. 4.3 – beyond the documentation of the manufacturer
2.2	Electrostatic Phenomena		There are no safety measures to adopt here because these are not problems associated with the machine		
2.3	Heat radiation or other phenomena (projection particles fuse, chemical effects resulting from short-circuits, overloads)				
2.4	External influences on the electrical equipment				

8.3 THERMAL RISK

	RISKS	RESIDUAL RISK ANALYSES		POSSIBILITY OF RESIDUAL RISKS	REFERENCE TOPIC
3.1	Burns and scorches, from contact with flames, explosions or other heat sources		There are no safety measures to adopt because these are not problems associated with the machine.		
3.2	Damage to health due to hot or cold work environments				

8.4 RISK ASSOCIATED WITH THE EMISSION OF NOISE FROM THE MACHINE

	RISKS	RESIDUAL RISK ANALYSES		POSSIBILITY OF RESIDUAL RISKS	REFERENCE TOPIC
4.1	Loss of the auditory ability (deafness) and other associated physiological damage (loss of the equilibrium, of the acquaintance)		There are no safety measures to adopt here because these are not problems associated with the machine		
4.2	Interferences with the verbal communication due to noise emitted by the machine, e.g. beeps				

8.5 RISK ASSOCIATED WITH THE VIBRATION OF THE MACHINE

	RISKS	RESIDUAL RISK ANALYSES		POSSIBILITY OF RESIDUAL RISKS	REFERENCE TOPIC
5.1	Dangers due to vibrations emitted (cause various neurological and vascular problems)	Ref. Extracted from EN414: - EN 292-1 - EN 292-2	The problem may be caused by those described in the troubleshooting section. Follow the instructions accordingly to solve such problems.	No residual risk present	Topic of Ref. Par. 7.1

8.6 RISK ASSOCIATED WITH THE EMISSION OF RADIATION

	RISKS	RESIDUAL RISK ANALYSES		POSSIBILITY OF RESIDUAL RISKS	REFERENCE TOPIC
6.1	Electrical arcs		There are no safety measures to adopt here because these are not problems associated with the machine.		
6.2	Laser				
6.3	Ionizing radiation				
6.4	Machines uses electromagnetic fields operating at a high frequency				

8.7 RISK ASSOCIATED WITH THE MATERIAL PROCESSED OR DISCHARGED BY THE MACHINE

	RISKS	RESIDUAL RISK ANALYSES		POSSIBILITY OF RESIDUAL RISKS	REFERENCE TOPIC
7.1	Dangers deriving from contact with or the inhalation of fluids, gas, mists, fumes or powders that have a harmful effect	Ref. Extracted from EN414: - EN 292-1 - EN 292-2	The machine described here does not handle materials of an explosive and/or corrosive nature. Should it be used for processing such materials, the manufacturers technical office should be contacted prior to use to take appropriate precautions.	No residual risk present	Topic of Ref. Par. 2.1
7.2	Danger of fire or explosion				
7.3	Biological or microbiological dangers (virus or bacteria)				

8.8 RISK ASSOCIATED WITH THE NON-COMPLIANCE WITH ERGONOMICS

	RISKS	RESIDUAL RISK ANALYSES		POSSIBILITY OF RESIDUAL RISKS	REFERENCE TOPIC
8.1	Incorrect Positioning or excessive strain		There are no safety measures to adopt here because these are not problems associated with the machine		
8.2	Inadequate consideration of the human anatomy: hand-arms or foot-leg				
8.3	Individual protective gear is not used				
8.4	Insufficient lighting system of the work area				
8.5	Excessive or insufficient mental engagement				
8.6	Human errors				

8.9 RISK ASSOCIATED WITH THE COMBINATION OF SEVERAL TYPES OF DANGER

	RISKS	RESIDUAL RISK ANALYSES		POSSIBILITY OF RESIDUAL RISKS	REFERENCE TOPIC
9.1	Human errors		There are no safety measures to adopt here because these are not problems associated with the machine.		

8.10 RISK ASSOCIATED WITH THE FAILURE IN THE SUPPLY OF ENERGY, BREAKAGE OF MACHINE PARTS AND OTHER MALFUNCTIONS

	RISKS	RESIDUAL RISK ANALYSES		POSSIBILITY OF RESIDUAL RISKS	REFERENCE TOPIC
10.1	Failure in energy supply		There are no safety measures to adopt here because these are not problems associated with the machine.		
10.2	Unexpected projection of parts of the machine, or fluid				
10.3	Failure, malfunction of the control system (starting suddenly, unexpected over travel)				
10.4	Assembly errors				
10.5	Unexpected loss of the stability of the machine				

8.11 RISK ASSOCIATED WITH THE (TEMPORARY) ABSENCE AND/OR INCORRECT PLACEMENT OF SAFETY MEASURES/INSTRUMENTS

	RISKS	RESIDUAL RISK ANALYSES		POSSIBILITY OF RESIDUAL RISKS	REFERENCE TOPIC
11.1	All types of guards		There are no safety measures to adopt here because these are not problems associated with the machine		
11.2	All safety devices for use in an emergency				
11.3	Starting and stopping devices				
11.4	Signs and safety signals				
11.5	All types of warning information and devices				
11.6	Devices for the disconnection of energy				
11.7	Emergency devices				
11.8	Means for loading/unloading the pieces				
11.9	Measuring devices, instruments and accessories fundamental for making adjustments and/or servicing in safe conditions				
11.10	Systems for eliminating gas, etc.				

8.12 RISK ASSOCIATED WITH THE MACHINE MOBILITY

	RISKS	RESIDUAL RISK ANALYSES		POSSIBILITY OF RESIDUAL RISKS	REFERENCE TOPIC
12.1	Dangers due to the mobility of the machine		There are no safety measures to adopt here because these are not problems associated with the machine		

8.13 RISK ASSOCIATED WITH LIFTING

	RISKS	RESIDUAL RISK ANALYSES		POSSIBILITY OF RESIDUAL RISKS	REFERENCE TOPIC
13.1	Dangers due to lifting risk	Ref. Extracted from EN414: - EN 292-1 - EN 292-2	The machine must only be raised and handled THROUGH SUITABLE MEANS	No residual risk present	Topic of Ref. Par. 3.2

8.14 RISK ASSOCIATED WITH LIFTING PERSONNEL

	RISKS	RESIDUAL RISK ANALYSES		POSSIBILITY OF RESIDUAL RISKS	REFERENCE TOPIC
14.1	Dangers to lifting personnel		Dangers to lifting personnel		

8.15 RISK ASSOCIATED WITH UNDERGROUND WORK

	RISKS	RESIDUAL RISK ANALYSES		POSSIBILITY OF RESIDUAL RISKS	REFERENCE TOPIC
15.1	Dangers with underground work		There are no safety measures to adopt because these are not problems associated with the machine.		

9 ADDITIONAL INSTRUCTIONS

9.1 WASTE DISPOSAL

Conforming to the laws in force in one's own country, the user is responsible for checking that the waste produced by the machine, during specific production activities, is fully and duly disposed of.

The user must also dispose of any oil, grease, etc. used for running the machine.

If the user complies with the manufacturer's most important guidelines, the entire plant will work better and the output will probably improve.

9.2 MACHINE DECOMMISSIONING AND DEMOLITION

The machine is built with the following materials:

- STEEL
- PLASTIC
- ELECTRICAL COMPONENTS
- LUBRICATING OIL/GREASE

The machine must be demolished at the end of its life cycle.

Remove the machine data plate and return it to the manufacturer.

Its parts and components must be properly separated in order to dispose of each one correctly.

This machine does not make use of highly polluting elements except for the grease used to lubricate the gearboxes.

The gearboxes and gears must be cleaned and all grease removed. The residues, obtained after the cleaning operations, must be placed into steel bins.

It is strictly prohibited to pour oils and solvents into the sewers or into the ground!

RECYCLING REGULATIONS



In all cases it is advisable to store all polluting materials such as oils, solvents etc. inside specific bins during the entire disposal process.

Generally speaking, as concerns the recycling of materials, the user must comply with the laws in force in his/her country during the entire plant disposal process.

9.3 DIRECTIONS FOR EMERGENCY SITUATIONS

The protections may be disabled only deliberately when a specific intervention is absolutely required. The person disabling the protections takes full responsibility for any associated risks.

IN THE EVENT OF A FIRE OUTBREAK, USE EXCLUSIVELY POWDER OR CARBON-DIOXIDE FIRE EXTINGUISHERS.

9.4 RETURNING THE MACHINE TO THE MANUFACTURER

In the event of the return of the machine, the customer is responsible for the repackaging and transport.

Where the packaging has been dismantled, the machine is to be sent back using a wooden crate and if needed wooden benches with the aid of suitable packaging film.

It should not be damaged during transport. The machine **MUST HAVE A COMPLETE** set of nameplates (identification, motors).

The returned machine must be cleaned, taking care to remove any residue arising from processed material, prior to return.

Remember that if your machine has been received in separate parts; the returned machine must be in this same condition and cleaned when returned.

9.5 LONG STORAGE TIME

If the machine is to be stored for a long period of time:

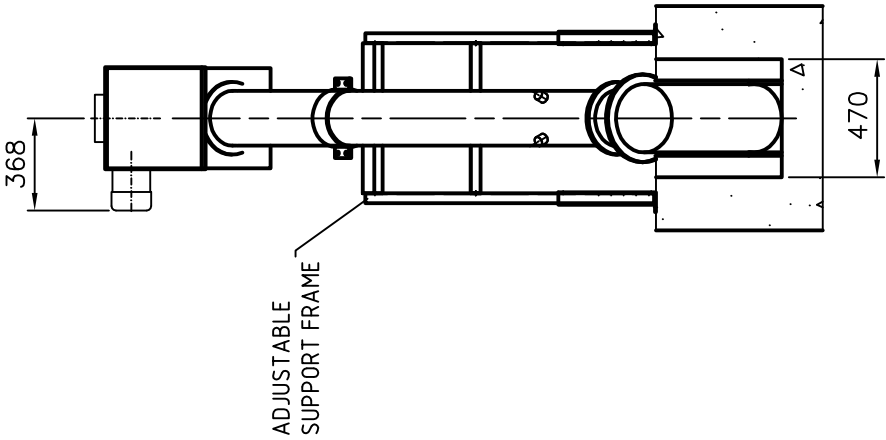
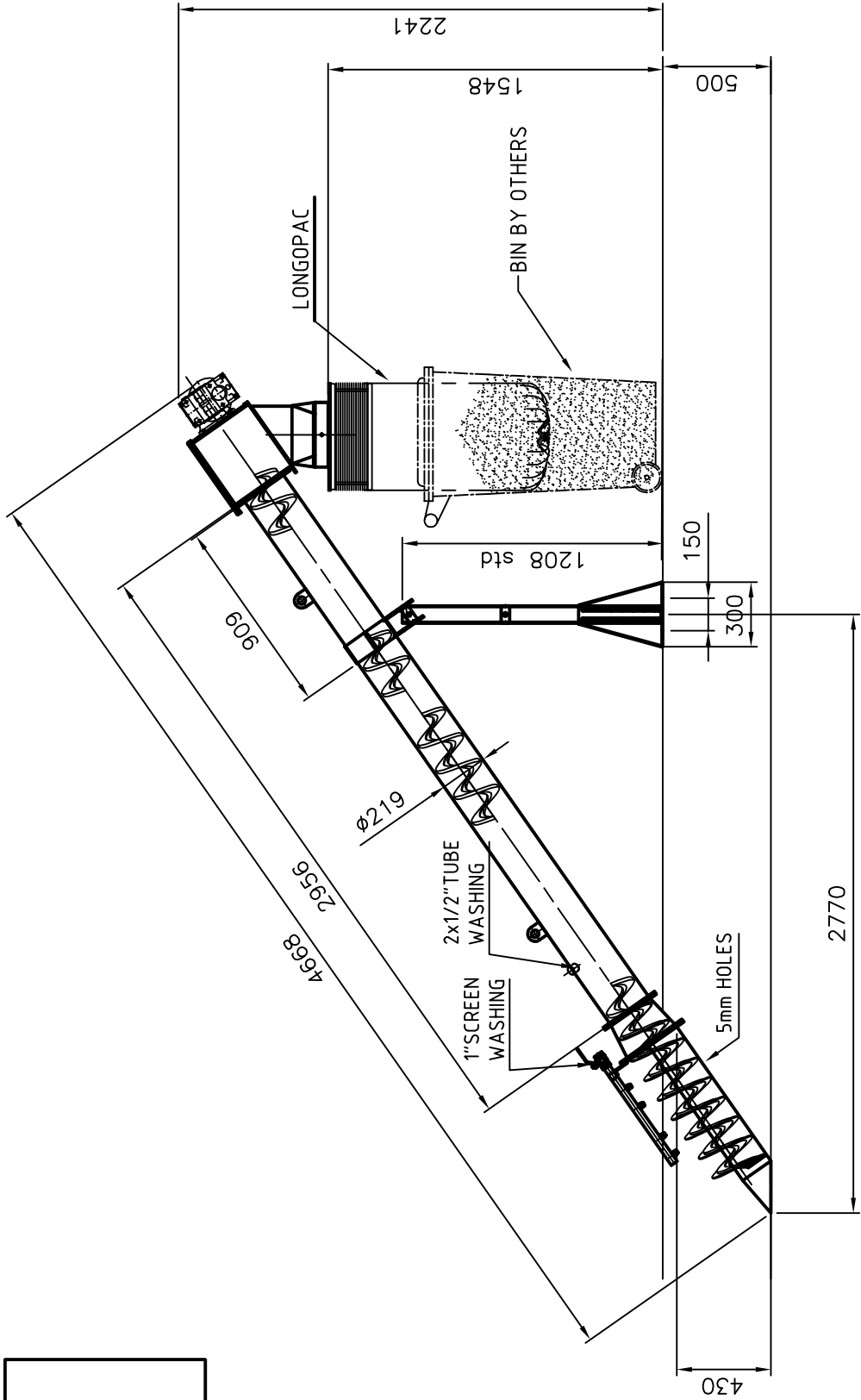
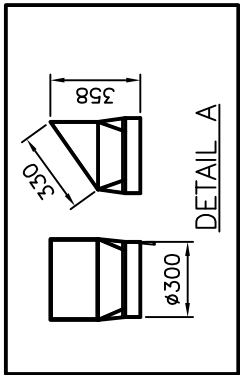
- Clean the following machine zones: screen, transport and dewatering.
- Place the machine inside a wooden crate, in a sheltered area.
- Geared motor: adhere to the instructions supplied in the handbook
- Before restarting the machine, start it as if it were its first startup.

ATTACHMENTS

1 DRAWINGS & SPECIFICATIONS

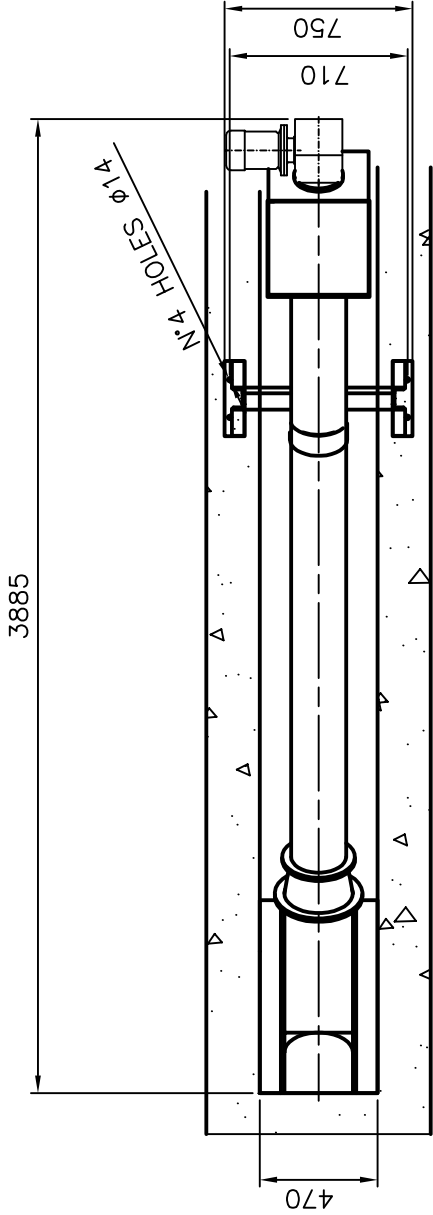
- SF3 GA Drawing 251540 : 134.14 - Rev 00
- Technical Specification Screen Extractor SF 3

- SF3 GA Drawing 251540: 134.14 - Rev 00



AS BUILT

GEARBOX SPECIFICATIONS	
GEARBOX MAKE	Rossi
GEARBOX TYPE	Worm Gear
GEARBOX MODEL	MRIV80
ELECTRIC MOTOR MAKE	Rossi
ELECTRIC MOTOR VHzPROTECT.	400/50/IP56(Multivoltage) (EFF1)
POWER INSTALLED	kW 0,75
ROTATION SPEED (Approx.)	RPM 11
CONSTRUCTION MATERIALS	
SUPPORT STAND	S.S. 304
SCREW LINER	S.S. 304
EXTERNAL SCREW IN GREEN SECTION	S.S. 304
SPIRAL	MICRO ALLOY TENSILE CARBON STEEL
BOLTS	A2 S.S. 304
CARPENTRY	S.S. 304
WEIGHT	
DRY WEIGHT	Kg. 430
WET WEIGHT	Kg. 450
SERIAL NUMBER	
18.134.14	



No.		BY	DATE	CHK	APP	DESCRIPTION	
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							

SCALE: 1				SF3			
DESIGNED	NAME	DATE		Kalbar WWTP			
DRAWN	LC	30/09/16		251540			
CHECKED				Project No	251540	Drawn No	
APPROVED							

134.14	11	12
00	A1	

CST Wastewater Solutions

Office/Warehouse: 16/20 Barcoo St, Roseville, NSW 2069 Sydney Australia.
Tel. 61 2 9417 3611 Fax 61 2 9417 0097
Postal: PO Box 82, Lane Cove, NSW 1595 Australia
Tel. 61 2 9427 1279 Fax 61 2 9427 3354
email : info@cstwastewater.com

- Technical Specification Screen Extractor SF 3

TECHNICAL SPECIFICATION

Type	Screen Extractor
Model	SF 3
Product to be screened	Sewage
Inlet Capacity (max.)	35 L/S
Inclination	35°
Spiral Model	Shaftless
Spiral Type	Reinforced
Channel Width (min.)	350 mm
Channel Depth (max.)	800 mm
Water Depth (max.)	435 mm
Screen Aperture	5mm
Discharge Height	1,600 mm
Gearbox Make	Rossi
Gearbox Type	Worm Gear
Gearbox Model	Rossi
Electric Motor Make	Rossi
Electric Motor V/Hz/Protect	400/50/IP 56
Power Installed	0.75 Kw
Rotation Speed	11 rpm (approx.)
Total Weight	430 kg (approx.)

CONSTRUCTION MATERIAL

Carpentry	Stainless Steel AISI 304
Bolts	Stainless Steel AISI 304
Screen Cleaning Screws	Stainless Steel AISI 304
Conveying Screw	Stainless Steel AISI 304
Screw Liner.	Stainless Steel Bars AISI 304

OTHER

Included:

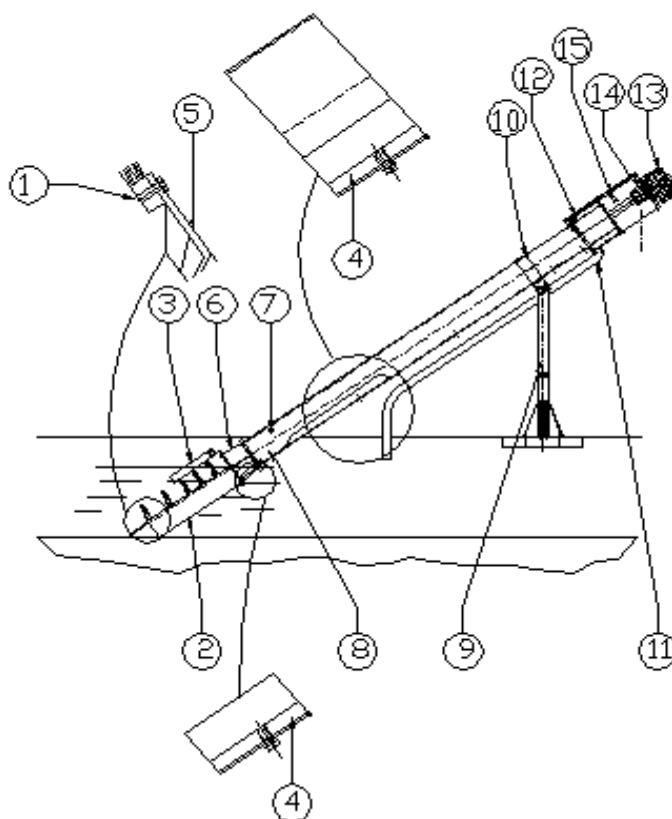
- Adjustable and pivoting supports
- Screen washing
- Screenings Washing
- Longopac Bagging unit

2

SPARE PARTS LIST

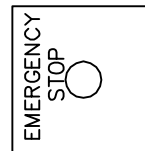
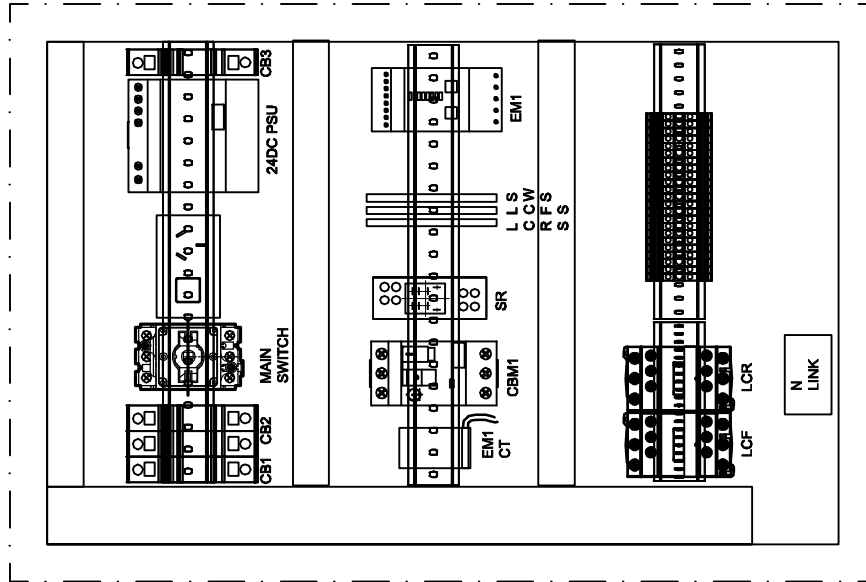
• Table & Diagram

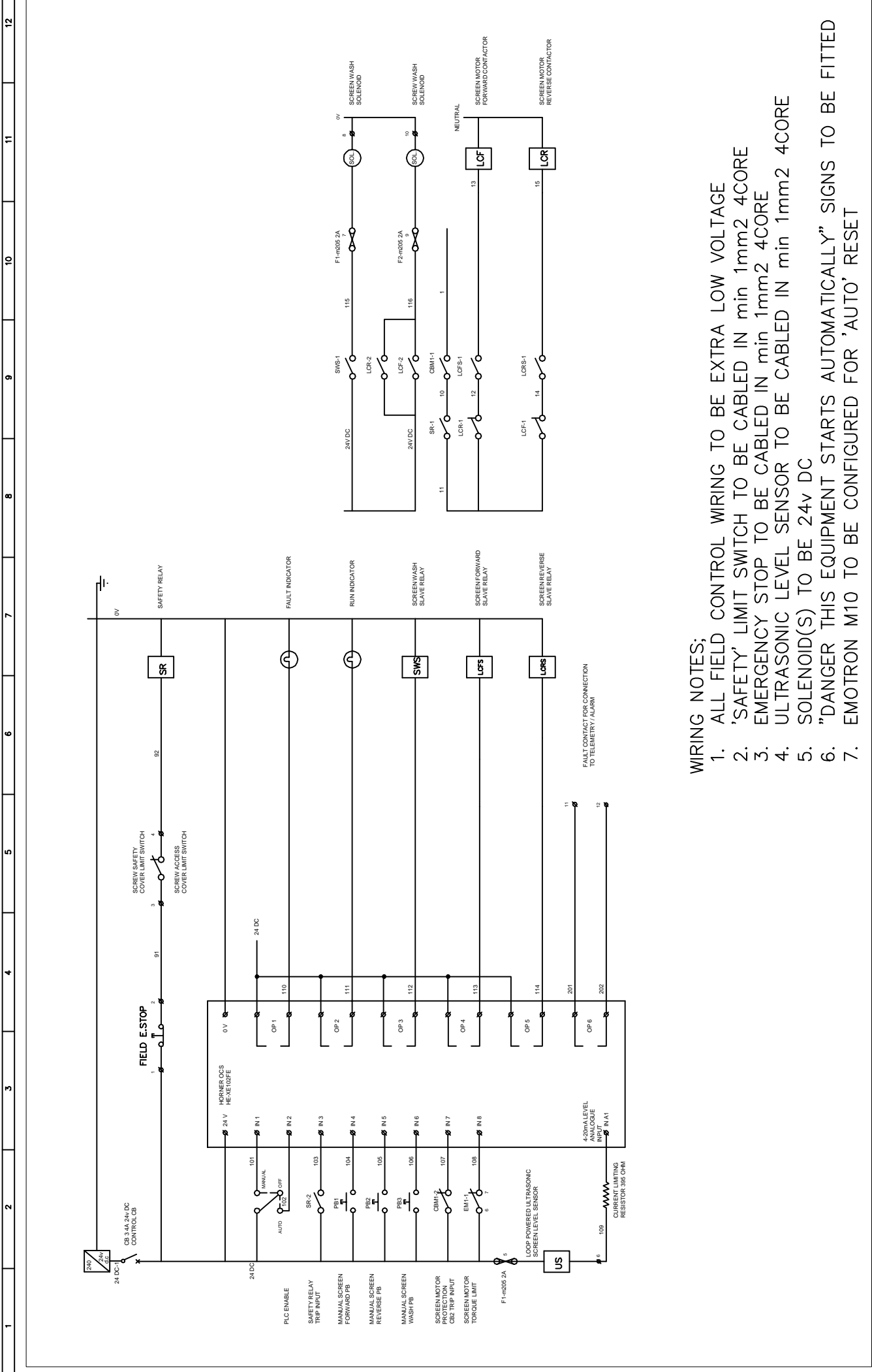
Pos.	Description	Qty.
1	Kit of cleaning brushes with fixing screws	1
2	Screen Basket	1
3	Screen washing system (when supplied)	1
4	Kit of wearing bars with fixing screws and seal gasket	1
5	Screw	1
6	Cone with fixing screws	1
7	Tube washing system (when supplied)	1
8	Tube complete with end flanges	1
9	Support	1
10	Support clamp with fixing screws	1
11	Geared Motor	1
12	Safety micro switch (when supplied)	1



3**CONTROL PANEL**

- Electrical Layout Drawing 14117-3
- Electrical Control Drawing 14117-2
- Electrical Single Line/Equipment Drawing 14117-1
- Functional Description
- Horner XLe/XLt OCS
- Emotron-F1 M10 Shaft Power Monitor
- Endress & Hauser Level Transmitter

[illegible]



WIRING NOTES:

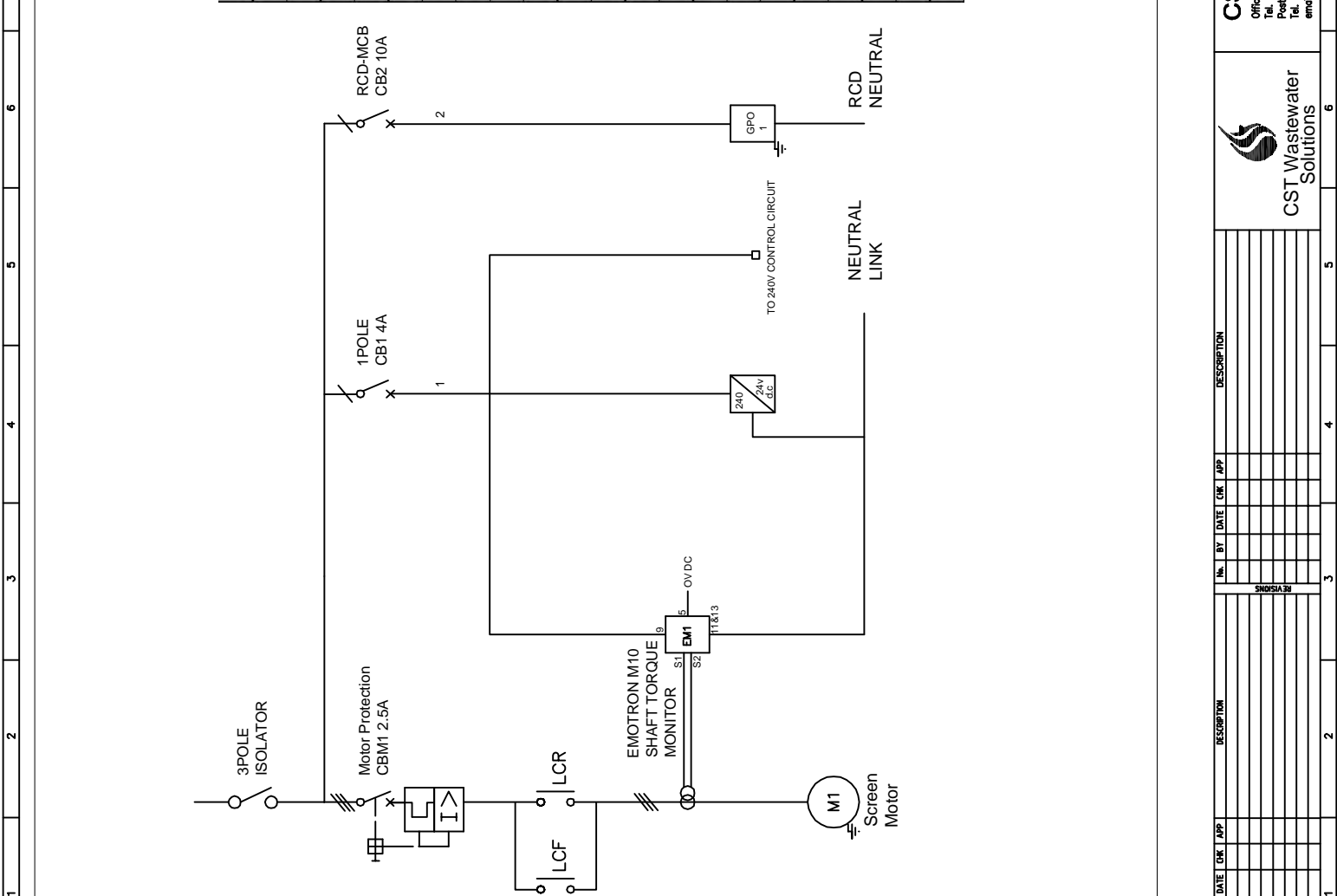
1. ALL FIELD CONTROL WIRING TO BE EXTRA LOW VOLTAGE
2. 'SAFETY' LIMIT SWITCH TO BE CABLED IN min 1mm2 4CORE
3. EMERGENCY STOP TO BE CABLED IN min 1mm2 4CORE
4. ULTRASONIC LEVEL SENSOR TO BE CABLED IN min 1mm2 4CORE
5. SOLENOID(S) TO BE 24v DC
6. "DANGER THIS EQUIPMENT STARTS AUTOMATICALLY" SIGNS TO BE FITTED
7. EMOTRON M10 TO BE CONFIGURED FOR 'AUTO' RESET

[illegible]

	7	8	9	10	11	12
	CONTROL PANEL EQUIPMENT SUMMARY					
	item	description	detail		supplier	
	1	enclosure	IP66 316SS 400w x 600h x 200d BS4062D-6		IPD	
	2	enclosure inner door	400w x 600h BID46		IPD	
	3	main isolator	V02 12A Isolator (VZ17 Shaft & KOC1YZ Operator)		Schneider Electric	
	4	circuit breakers 1p	din GE Redline rating to suit G61Cm 6ka		IPD	
	5	circuit breakers 3p	din GE Redline rating to suit G63Cm 6ka		IPD	
	6	rccb	din GE contractor 10A 30mA		IPD	
	7	motor CBs	GV2MEInn rating to suit motors		Schneider Electric	
	8	motor CB aux	GVAE11 1 x n/o / 1 x n/c		Schneider Electric	
	9	contactors	LC1D09U7 up to 4kw		Schneider Electric	
	10	power supply	240ac/24dc 2.5A DR60-24 Elko		IPD	
	11	controller	Homer OCS XE102FE		NetworkAutomation	
	12	motor torque relay	EL-FI M10 + CTM10 current transformer		Siemens Ensby	
	13	estop	XALK174		Schneider Electric	
	14	PBs	ZB5AA38 + ZB5AZ101		Schneider Electric	
	15	indicators	XB5AVBx (green=3, red=4)		Schneider Electric	
	16	auto-off-man select	ZB5AD3 + ZB5AZ103		Schneider Electric	
	17	safety relay	2P RVM2AB2BD + RVZE2S108M base		Schneider Electric	
	18	GPO	4SS015		Clipsal	
	19	ultrasonic level sensor	4-20mA Loop Powered Prosonic FMU30, 0-5m span		Endress&Hauser	
	20	slave relays	700TBR24+ 700HLT1U (or =)		AB or =	

SCALE:		NTS		KALBAR STP EFFLUENT INLET SCREEN ELECTRICAL SINGLE LINE / EQUIPMENT
DRAWN	DESIGNED	MAKE	DATE	
BSANTILL		MARSON	FEB 2014	
APPROVED				
Project No: 251540				Original: 14117-1

ST Wastewater Solutions
 Warehouse: 16/20 Burcoo St. Roseville, NSW 2068 Sydney Australia.
 Tel: 61 2 9417 3611 Fax: 61 2 9417 0097
 Post: PO Box 82, Lane Cove NSW 1585 Australia
 E : info@sttechnology.com.au

[illegible]

10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	-----

Q-Pulse Id: TMS009 Active: 14/05/2014 Page 52 of 241

- Functional Description

Kalbar Effluent Inlet Screen; May 2014

GENERAL

- 1 if any Stop is tripped (in either Auto or Manual) all motors & solenoids etc will stop immediately (if operating) and will stay stopped until reset and restarted (switched off and then back into manual / auto).
- 2 if any safety limit switch(es) trip all motors & solenoids etc will stop and stay stopped until reset and restarted (switched off and then back into manual / auto).
- 3 Stop or Safety Limit trips will reset all timers and the cycle will recommence from fresh when reset / restarted.
- 4 While ever any motor / cycle / solenoid is operating the green 'Run' indicator will be on
- 5 SV1 will operate while ever the 'WASH' button is pressed (assuming Stop is OK, and in Auto or Man)
- 6 SV2 will only operate whenever the screen motor is running (forward or reverse)
- 7 System to have local controller with Manual / Off / Automatic control switch; Select 'Auto' or 'Manual' as required.
- 8 if 'Off' selected at any time in a cycle, the motor and solenoid will stop operating immediately and the cycle will be reset.

XE102 Operator Control Station (OCS) Operations

The operator control station is a Horner HE-XE102 unit with display and interface buttons.

- i. normal display is inlet level transmitter percentage level
- ii. Press either of the LHS side arrow buttons to scroll back and forward through displays / parameter list
- iii. Use the centre down arrow / up arrow to locate parameter to be adjusted
- iv. Press 'enter' to select value
- v. Use number keys to enter new value (or press 'esc' to exit without changing)
- vi. Press 'enter' to confirm changes
- vii. Do not set any parameter value to zero ('0')

LEVEL TRANSMITTER

The level transmitter provided is an Endress + Hauser Prosonic T, connected for loop-powered 4-20mA operation.

It is connected to the XE102 OCS which will display the inflow level. Ensure the Prosonic T is properly configured to suit the actual installation, then adjust the OCS operating levels as desired. (bottom of channel = 0%, inlet channel full =[up to] 100%; ensure transmitter is installed at least 200mm above the highest possible liquid level, and ensure scale is adjusted in level transmitter.

MANUAL SYSTEM OPERATION:

- i. Select 'Man'
- ii. press each of the pushbuttons to 'jog' M1 / wash solenoid as required
- iii. outputs will only energise if the safety relay is energised
- iv. outputs will only stay energised so long as the button is pressed

Automatic Operation; is timer and level controlled

- i. LSL - Stopping signal
- ii. LSH - Starting Signal
- iii. LSHH - Inlet Level alarm high level

Select 'Auto'. If below LSH, the Screw wash solenoid will energise to confirm operation, for period KY9. The system will then sit idle until the level rises above setpoint.

As the water flows through the screen, the solids captured in the screen basket blocks the screen apertures and cause the water level in the inlet channel to rise. The Ultrasonic Level sensor monitors the rising level, providing an analogue signal proportional to the channel level; this enables setpoints 'LSL' / 'LSH' / 'LSHH' operation.

- a. M1 will not run unless the level is above 'LSL'. (If operating and the level drops below 'LSL' then M1 will stop immediately)
- b. When the level rises to 'LSH', the system cycle timer (settable in KY1, typically 2-30 minutes) is energised
- c. When KY1 energises, M1 screen will start in forward, run for minimum run time (settable in KY5, nominal 10 seconds), and continue to run for cycle time (KY1)
- d. If the level has dropped below 'LSH' after KY1 is elapsed then M1 will stop
- e. While ever the level remains above 'LSH', once started M1 will continue to run
- f. After M1 stops, every *nn* cycles (settable in C1, nominal 1-5) M1 will auto-reverse (see notes below)
- g. If the water level reaches 'LSHH', then M1 will auto-reverse (see notes below) and timer KY4 will start timing. If the level does not then fall below 'LSHH' within time period KY4 then Fault output will be set but cycle will continue.
- h. Whenever any motor overload or safety relay is tripped a Fault will be set
- i. Whenever the system sequence is complete in a normal cycle the SV1 (Screen Wash) solenoid will activate for (KY6, default 60 seconds) time
- j. If the (Emotron) torque monitor activates, M1 stops and auto-reverses then reverts to running forward.
- k. Each time the (Emotron) torque limit activates, a counter (C2, default max count = 3) will be set, and if the torque limit operates 'xx' times within (KY8, nominal 6 minutes) time then the system will stop and activate the 'Fault' output.
- l. If the torque limit activates whilst in reverse then M1 will stop, stay stopped and activate the 'Fault' output / message.

NOTES:

- 1 Auto-reverse (To clear jams, improve cleaning efficiency and extend life of brushes); when initiated runs for (KY2; 5-10 seconds). There will be a (KY7, default 3 second) delay between forward and reverse changes.
- 2 'Fault';
 - a. the 'Fault' indicator will illuminate, and stay on until the fault is rectified and reset (switched off and then back into manual / auto)
- 3 Washing – Screen;
 - a. Screen washing solenoid (SV1) will be activated on a timer basis (settable in KY3, Typically 1 minute every 2 minutes) whenever M1 is running in Auto.
 - b. SV1 will also be activated while ever the Auto-Reverse function is operating
 - c. SV1 will also be activated for 'nn' (settable in KY5, nominal 30 seconds) after M1 stops

EQUIPMENT

1. Motors

- a. Inlet Screen - M1; 0.75kW, 2.05A fla

CONTROLS

1. Timers

- a. KY1 - Screening System cycle timer
 b. KY2 - Auto-reverse reverse run timer
 c. KY3 - recycling Screen Washing timer
 d. KY4 - High High level alarm on-delay timer
 e. KY5 - M1 minimum run timer
 f. KY6 - 'screen wash after cycle' timer
 g. KY7 - forward / reverse changeover delay timer
 h. KY8 - excess over torque event alarm on-delay timer
 i. KY9 - wash solenoid on timer

2. Ultrasonic level control (4-20mA loop powered, 0-3m capable set for nominal 0-1m)

- a. LSL - System Stop Level
 b. LSH - System Start Level
 c. LSHH - High High Level (alarm after delay KY4)

3. Solenoid Valves (24v DC)

- a. SV1 - Screen Washing
 b. SV2 - Screw Washing

4. Torque Limiters

- a. JET 1 - Inlet Screen M1 – Torque monitor
 b. JAH 1 - Inlet Screen M1 high torque setpoint

5. Counters

- a. C1 - cycle count for start auto-reverse function
 b. C2 - cycle count for excess high torque events trip

ALARM OUTPUT (causes)

1. Inlet channel LSHH level time out (KY4)
 2. Motor CB Trip M1
 3. Excessive Trips High Torque M1

- Horner HE-XE 102



User Manual for

**HE-XT100, HE-XT102, HE-XT103, HE-XT104
HEXE220C100/HEXE220C000, HEXT240C100/HEXT240C000
HEXE220C112 / HEXE220C01, HEXT240C112 / HEXT240C012
HEXE220C114 / HEXE220C014, HEXT240C114 / HEXT240C014
HEXE220C113 / HEXE220C013, HEXT240C113 / HEXT240C013
HEXE220C115 / HEXE220C015, HEXT240C115 / HEXT240C015**

XLe/XLt OCS

MAN0878-02-EN

PREFACE

This manual explains how to use the XLe/XLt OCS Modules.

Copyright (C) 2008 Horner APG, LLC., 59 South State Avenue, Indianapolis, Indiana 46201. All rights reserved. No part of this publication may be reproduced, transmitted, transcribed, stored in a retrieval system, or translated into any language or computer language, in any form by any means, electronic, mechanical, magnetic, optical, chemical, manual or otherwise, without the prior agreement and written permission of Horner APG, Inc.

All software described in this document or media is also copyrighted material subject to the terms and conditions of the Horner Software License Agreement.

Information in this document is subject to change without notice and does not represent a commitment on the part of Horner APG.

Cscape, SmartStack, SmartStix and CsCAN are trademarks of Horner APG.

Ethernet is a trademark of Xerox Corporation.

Micro SD and CompactFlash are registered trademarks of SanDisk Corporation.

For user manual updates, contact Technical Support:

North America:

(317) 916-4274

www.heapg.com

email: techspt@heapg.com

Europe:

(+) 353-21-4321-266

www.horner-apg.com

email: techsupport@hornerirl.ie

LIMITED WARRANTY AND LIMITATION OF LIABILITY

Horner APG, LLC. ("HE-APG") warrants to the original purchaser that the XLe/XLt OCS module manufactured by HE-APG is free from defects in material and workmanship under normal use and service. The obligation of HE-APG under this warranty shall be limited to the repair or exchange of any part or parts which may prove defective under normal use and service within two (2) years from the date of manufacture or eighteen (18) months from the date of installation by the original purchaser whichever occurs first, such defect to be disclosed to the satisfaction of HE-APG after examination by HE-APG of the allegedly defective part or parts. THIS WARRANTY IS EXPRESSLY IN LIEU OF ALL OTHER WARRANTIES EXPRESSED OR IMPLIED INCLUDING THE WARRANTIES OF MERCHANTABILITY AND FITNESS FOR USE AND OF ALL OTHER OBLIGATIONS OR LIABILITIES AND HE-APG NEITHER ASSUMES, NOR AUTHORIZES ANY OTHER PERSON TO ASSUME FOR HE-APG, ANY OTHER LIABILITY IN CONNECTION WITH THE SALE OF THIS XLe/XLt OCS module. THIS WARRANTY SHALL NOT APPLY TO THIS XLe/XLt OCS module OR ANY PART THEREOF WHICH HAS BEEN SUBJECT TO ACCIDENT, NEGLIGENCE, ALTERATION, ABUSE, OR MISUSE. HE-APG MAKES NO WARRANTY WHATSOEVER IN RESPECT TO ACCESSORIES OR PARTS NOT SUPPLIED BY HE-APG. THE TERM "ORIGINAL PURCHASER", AS USED IN THIS WARRANTY, SHALL BE DEEMED TO MEAN THAT PERSON FOR WHOM THE XLe/XLt OCS module IS ORIGINALLY INSTALLED. THIS WARRANTY SHALL APPLY ONLY WITHIN THE BOUNDARIES OF THE CONTINENTAL UNITED STATES.

In no event, whether as a result of breach of contract, warranty, tort (including negligence) or otherwise, shall HE-APG or its suppliers be liable of any special, consequential, incidental or penal damages including, but not limited to, loss of profit or revenues, loss of use of the products or any associated equipment, damage to associated equipment, cost of capital, cost of substitute products, facilities, services or replacement power, down time costs, or claims of original purchaser's customers for such damages.

To obtain warranty service, return the product to your distributor with a description of the problem, proof of purchase, post paid, insured and in a suitable package.

ABOUT PROGRAMMING EXAMPLES

Any example programs and program segments in this manual or provided on accompanying diskettes are included solely for illustrative purposes. Due to the many variables and requirements associated with any particular installation, Horner APG cannot assume responsibility or liability for actual use based on the examples and diagrams. It is the sole responsibility of the system designer utilizing the XLe/XLt OCS module to appropriately design the end system, to appropriately integrate the XLe/XLt OCS module and to make safety provisions for the end equipment as is usual and customary in industrial applications as defined in any codes or standards which apply.

Note: The programming examples shown in this manual are for illustrative purposes only. Proper machine operation is the sole responsibility of the system integrator.

Table of Contents

VISUAL MAP OF MAJOR TASKS AND THE KEY CHAPTERS TO ASSIST YOU	8
CHAPTER 1 : SAFETY / COMPLIANCE	9
1.1 Safety Warnings and Guidelines	9
1.2 Grounding	10
1.3 CE Compliance	10
CHAPTER 2 : INTRODUCTION	11
2.1 Visual Overview of XLe/XLt and Topics Covered in this Manual	11
2.1.1 Where to Find Information about the XLe/XLt	11
2.2 Connectivity to the XLe/XLt	12
2.2 Features of XLe/XLt	12
2.3 Required and Suggested Accessories	13
2.4 Useful Documents and References	14
CHAPTER 3 : MECHANICAL INSTALLATION	15
3.1 Overview	15
3.2 Mounting Requirements	15
3.2.1 Mounting Procedures (Installed in a Panel Door)	15
3.2.2 Mounting Procedures (Installed on DIN Rail)	16
3.3 Mounting Orientation	16
3.4 Panel Cut-Out	17
3.5 Dimensions	17
3.6 Factors Affecting Panel Layout Design and Clearances	18
3.6.1 Clearance / Adequate Space	18
3.6.2 Grounding	18
3.6.3 Temperature / Ventilation	18
3.6.4 Orientation	19
3.6.5 Noise	19
3.6.6 Shock and Vibration	19
3.6.7 Panel Layout Design and Clearance Checklist	19
CHAPTER 4 : ELECTRICAL INSTALLATION	21
4.1 Grounding Definition	21
4.2 Ground Specifications	21
4.3 How to Test for Good Ground	21
4.4 Primary Power Port	22
CHAPTER 5 : SERIAL COMMUNICATIONS	23
5.1 Overview	23
5.2 Port Descriptions	23
5.3 Wiring	23
5.4 RS-485 Termination	24
5.5 RS-485 Biasing	24
5.6 Cscape Programming via Serial Port	24
5.7 Ladder-Controlled Serial Communication	24
5.8 Downloadable Serial Communication Protocols	24
CHAPTER 6 : CAN COMMUNICATIONS	25
6.1 Overview	25
6.2 Port Description	25
6.3 Wiring	25
6.4 Cscape Programming via CAN	26
6.5 Ladder-Controlled CAN Communication	26
6.6 Using CAN for I/O Expansion (Network I/O)	26
CHAPTER 7 : COMMUNICATION OPTIONS	27
7.1 Overview	27
7.1.1 MJ1 shares	27
7.2 Ethernet COM Module (XEC) Option	27

7.3	Modem COM Module (XMC) Option	28
CHAPTER 8 : REMOVABLE MEDIA		29
8.1	Overview	29
8.2	Micro SD Cards	29
	To install a Micro SD card	29
	To remove the Micro SD card	29
8.3	Micro SD File System	29
8.4	Using the Removable Media Manager	30
8.5	Using Removable Media to Log Data	30
8.6	Using Removable Media to Load and Save Applications	30
8.7	Using Removable Media to View and Capture Screens	31
CHAPTER 9 : GENERAL I/O		33
	Note: Each XLe/XLt unit is sent with a datasheet in the box	33
9.1	Overview	33
9.2	Removing the XLe/XLt Back Cover	33
9.3	Model and I/O Overview	34
	Table 9.1 shows the different types of I/O	34
9.4	Solid-State Digital Outputs	35
	Note: The digital outputs used on the XLe/XLt are "sourcing" outputs	35
9.5	Relay Outputs	35
	Note: The design of the XLe/XLt does not require external coil power for the relays	35
9.6	Digital Inputs	37
	Note: The digital inputs on the XLe/XLt are designed for low voltage DC inputs	37
9.7	Analog Inputs	37
	Note: See the data sheet for the XLe/XLt model you are using for jumper settings and CHAPTER 14 for details on how to use Cscope to configure the digital filtering.	37
9.8	Universal Analog Inputs	38
9.9	Analog Outputs	38
CHAPTER 10 : HIGH SPEED I/O (HSC / PWM)		39
10.1	Overview	39
10.2	High Speed Counter (HSC) Functions	39
10.2.1	Frequency	39
10.2.2	Totalize	39
10.2.3	Pulse	40
10.2.4	Quadrature	41
10.3	HSC Functions Register Map	45
10.4	Pulse Width Modulation (PWM) Functions	45
10.4.1	Normal	45
10.4.2	PWM	45
10.4.3	HSC (High Speed Counter)	47
10.4.4	Stepper Function	47
	Start Frequency (cycles per second)	47
	Run Frequency (cycles per second)	47
	Acceleration Count	47
	Run Count	47
	Deceleration Count	47
	Ready/Done	48
	Error	48
10.5	PWM functions register map	49
10.6	PWM Examples	49
10.7	STP Examples	50
CHAPTER 11 : SYSTEM SETTINGS AND ADJUSTMENTS		51
11.1	System Menu - Overview	51
11.2	System Menu – Navigation and Editing	52
11.3	System Menu – Details	53
CHAPTER 12 : USER INTERFACE		61

12.1	Screen Navigation.....	61
12.2	Ladder Based Screen Navigation	62
12.3	Using Editable Screen Objects	62
CHAPTER 13	: REGISTERS.....	65
13.1	Register Definitions	65
13.2	Useful %S and %SR registers	66
13.3	Register Map for XLe/XLt I/O	67
13.4	Resource Limits	68
CHAPTER 14	: CSCAPE CONFIGURATION	70
14.1	Overview	70
14.2	Cscape Status Bar	70
14.3	Establishing Communications.....	71
14.4	Models supported.....	71
14.5	Configuration.....	71
14.6	Digital Input / HSC Configuration.....	72
14.7	Digital Output / PWM Configuration.....	74
14.8	Analog Input Configuration	75
14.9	Analog Output Configuration.....	76
CHAPTER 15	: MAINTENANCE.....	78
15.1	Firmware Updates.....	78
15.2	Backup Battery.....	78
15.2.1	Indications the battery needs replacing.....	78
15.2.2	Battery Replacement.....	79
CHAPTER 16	: TROUBLESHOOTING / TECHNICAL SUPPORT	80
16.1	Connecting to the XLe/XLt	80
16.1.1	Connecting Troubleshooting Checklist.....	81
16.2	Local Controller and Local I/O	81
16.2.1	Local I/O Troubleshooting Checklist.....	81
16.3	CsCAN Network.....	82
16.3.1	CsCAN Network Troubleshooting Checklist.....	82
16.4	Removable Media	83
16.4.1	Basic Troubleshooting.....	83
16.5	Technical Support Contacts.....	83
INDEX	84
	Table of Figures.....	86

VISUAL MAP OF MAJOR TASKS AND THE KEY CHAPTERS TO ASSIST YOU

The following map is provided to show you the major types of tasks needed to be performed and the key chapters in this manual you need to refer to for information and help.

Directions: Major tasks are listed at the top of the map with the key chapters listed beneath that you need to consult in order to perform the tasks.

FIRST STEP of ANY TASK: DATASHEET			
Each XLe/XLt unit is sent with a datasheet in the box. The datasheet is the first document you need to refer to for model-specific information related to XLe/XLt models such as pin-outs, jumper settings, and other key installation information. The web version of this manual has all of the XLe/XLt datasheets attached to it. Visit our website (see page 83) to obtain updates to datasheets and user documentation.			
QUICK START	INSTALLATION	PROGRAMMING	TROUBLESHOOTING
Safety / Compliance page 9	Safety / Compliance page 9	Safety / Compliance page 9	Safety / Compliance page 9
Introduction page 11	Introduction page 11	Introduction page 11	Introduction page 11
	Mechanical Installation page 15	System Settings page 51	Maintenance page 78
	Electrical Installation page 21	Cscape Configuration page 70	Troubleshooting page 80
	Serial Comm page 23	User Interface page 61	
	CAN Comm page 25	Removable Media page 29	
	Communication Options page 27	General I/O page 33	
	General I/O page 33	High Speed I/O page 39	
		Registers page 65	

CHAPTER 1: SAFETY / COMPLIANCE

1.1 Safety Warnings and Guidelines

When found on the product, the following symbols specify:



Warning: Consult user documentation.



Warning: Electrical Shock Hazard.

WARNING: To avoid the risk of electric shock or burns, always connect the safety (or earth) ground before making any other connections.

WARNING: To reduce the risk of fire, electrical shock, or physical injury it is strongly recommended to fuse the voltage measurement inputs. Be sure to locate fuses as close to the source as possible.

WARNING: Replace fuse with the same type and rating to provide protection against risk of fire and shock hazards.

WARNING: In the event of repeated failure, do not replace the fuse again as a repeated failure indicates a defective condition that will not clear by replacing the fuse.

WARNING: Only qualified electrical personnel familiar with the construction and operation of this equipment and the hazards involved should install, adjust, operate, or service this equipment. Read and understand this manual and other applicable manuals in their entirety before proceeding. Failure to observe this precaution could result in severe bodily injury or loss of life.

- All applicable codes and standards need to be followed in the installation of this product.
- For I/O wiring (discrete), use the following wire type or equivalent: Belden 9918, 18 AWG or larger.

Adhere to the following safety precautions whenever any type of connection is made to the module.

- Connect the green safety (earth) ground first before making any other connections.
- When connecting to electric circuits or pulse-initiating equipment, open their related breakers. Do not make connections to live power lines.
- Make connections to the module first; then connect to the circuit to be monitored.
- Route power wires in a safe manner in accordance with good practice and local codes.
- Wear proper personal protective equipment including safety glasses and insulated gloves when making connections to power circuits.
- Ensure hands, shoes, and floor are dry before making any connection to a power line.
- Make sure the unit is turned OFF before making connection to terminals. Make sure all circuits are de-energized before making connections.
- Before each use, inspect all cables for breaks or cracks in the insulation. Replace immediately if defective.

1.2 Grounding

Grounding is covered in various chapters within this manual.

- For grounding specifications and testing for a good ground, refer to page **21**.
- For panel grounding, refer to **18**.

1.3 CE Compliance

To check for compliance and updates, visit our website at:

<http://www.heapg.com/Pages/TechSupport/ProductCert.html>

CHAPTER 2: INTRODUCTION

2.1 Visual Overview of XLe/XLt and Topics Covered in this Manual

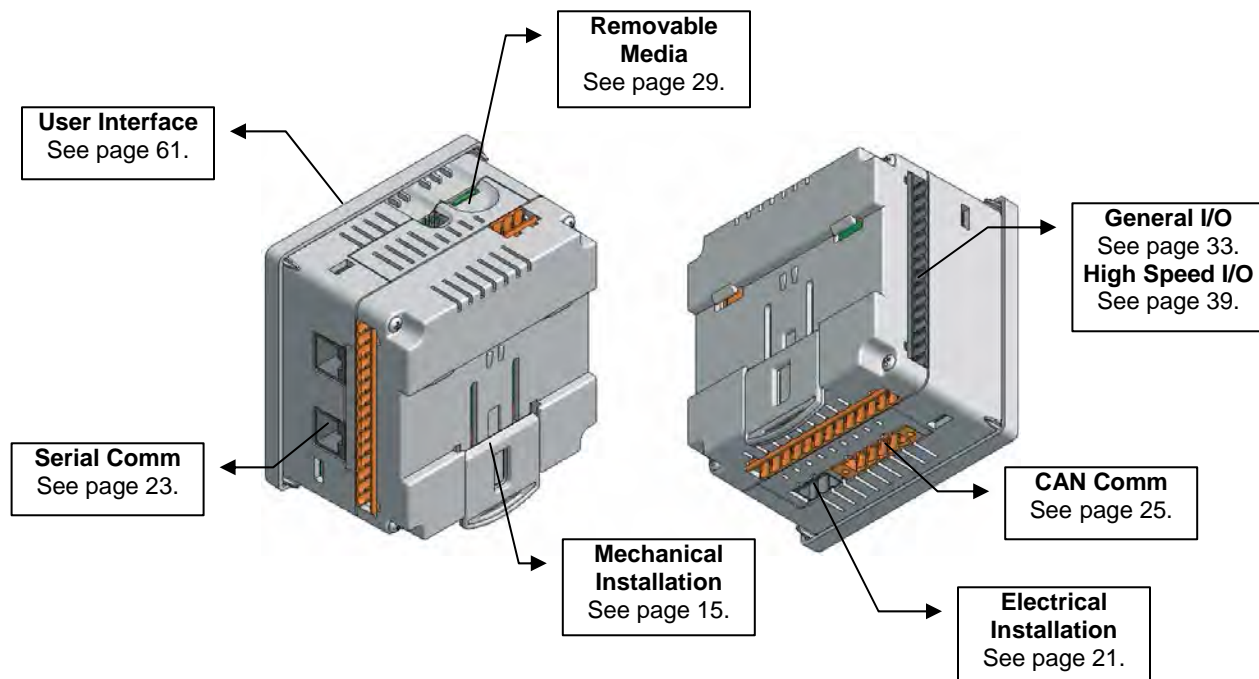


Figure 2.1 – Visual Overview of XLe/XLt and Topics of Interest Covered in the User Manual

2.1.1 Where to Find Information about the XLe/XLt

a. Datasheets - The **datasheets are the first documents you need to refer to for key information** related to specific XLe/XLt models. (A datasheet is provided in the box with your unit.)

The datasheets for all XLe/XLt models are attached to the back of this manual on our website, and they are also available individually on the web.

Datasheets contain pin-outs, jumper settings and other model specific information.

b. User Manual -This manual provides general information that is common to XLe/XLt models and can be downloaded from our web. Visit our website (see page **83**) to obtain user documentation and updates.

Four main types of information are covered in the manual.

- Safety and Installation guidelines / instructions (Mechanical and Electrical)
- Descriptions of hardware features (Serial ports, Removable Media, Communication Options, etc.)
- Configuration and Use of the XLe/XLt
- Maintenance and Support

2.2 Connectivity to the XLe/XLt

The XLe/XLt has tremendous capabilities for connecting to a variety of devices. The diagram below shows some examples of devices that can be used with the XLe/XLt.

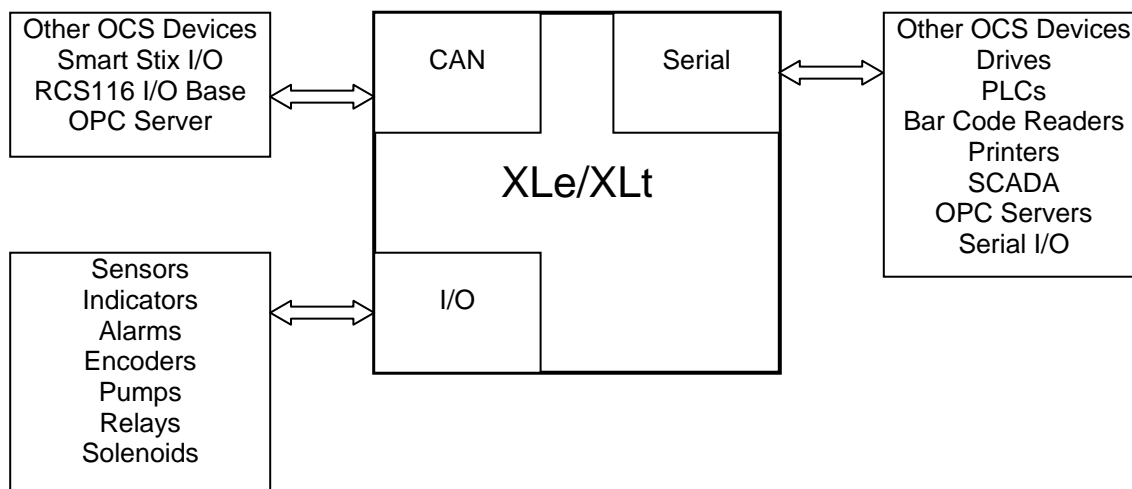


Figure 2.2 – Visual Overview of Types of Devices that can be connected to XLe/XLt

2.2 Features of XLe/XLt

The XLe/XLt is an all-in-one industrial control device. It combines control, user interface, I/O and networking into a single, integrated package. Unique features of the XLe/XLt include:

- Bright, graphical LCD display (in XLe) (with touch sensing in XLt)
- Display of complex graphical objects including trends, gauges, meters and animations
- Advanced control capabilities including floating point, multiple auto-tuning PID loops and string handling capabilities
- Removable media for up to one gigabyte of storage of programs, data logging or screen captures
- CsCAN networking port (optional) for communication with remote I/O, other controllers or PCs
- Configurable serial protocols for communication to drives, PLCs, or other serial peripherals
- Full featured, built-in I/O including high resolution analog, thermocouple, RTD, high speed counters, PWM outputs and relays (depending upon the XLe/XLt model used)
- Cscape programming software that allows all aspects of the XLe/XLt to be programmed and configured from one integrated application
- Optional communication add-on modules that allow additional capabilities such as Ethernet or modems

2.3 Required and Suggested Accessories

The following list contains a sampling of required and suggested XLe/XLt accessories. Visit our website (see page 83) to view updates on new products and accessories.

Note: The XLe/XLt is not shipped with a programming cable in the box. To obtain a programming cable, order HE500CBL300.

Table 2.1 – XLe/XLt Accessories	
Part Number	Description
HE-XEC	10/100 Ethernet option kit - field installable. Kit includes all parts necessary for internal installation within the XLe/XLt case, including a deeper plastic back cover adapted for Ethernet operation.
HE-XMC	14.4 k Telephone modem option kit - field installable. Kit includes all parts necessary for internal installation within the XLe/XLt case, including a deeper plastic back cover adapted for modem operation.
HE-MC1	Removable Media card - compatible with XLe/XLt. Card capacity is 256 MB or larger.
HE-MR1	Media Card Reader for HE-MC1. Portable device allows HE-MC1 to be plugged into the USB port of personal computers as a portable hard drive.
HE-X24-AS	Power supply 100-240VAC or 140-340VDC Switching supply that outputs 1.5 A / 3 A (HE-X24-AS/AL) at 24 VDC. Mounts on Standard DIN rail. Designed for X Family products.
HE-X24-AL	Power supply 100-240 VAC or 140-340 VDC Switching supply that outputs 1.5 A / 3 A (HE-X24-AS/AL) at 24VDC. Mounts on Standard DIN rail. Designed for X Family products.
HE500OSW232	Cscape Software Package. Includes Cscape CD, 9-pin OCS Programming Cable, RJ-45 Programming Cable, Documentation
HE500CBL300	OCS Programming Cable, 9-pin female (PC) to RJ-45 (OCS) - 6 feet.
HE500USB600	USB programming kit. Includes USB to RS-232 adapter, and 6-foot RS-232 cable with D-sub connections. Requires HE500CBL300 to program the XLe/XLt.

2.4 Useful Documents and References

The following information serves as a *general* listing of Horner controller products and other references of interest with their corresponding manual numbers. Visit our website (see page **83**) to obtain user documentation and updates.

Note: This list is <u>not</u> intended for users to determine which products are appropriate for their application; controller products differ in the features that they support. If assistance is required, refer to Technical Support (page 83).	
Controllers	Manual Number
XLe Series (e.g., HE-XExxx)	MAN0878
XLt Series (e.g., HE-XTxxx)	MAN0878
QX Series (e.g., HE-QXxxx)	MAN0798
NX Series (e.g., HE-NXxxx)	MAN0781
LX Series (e.g., LX-xxx; also covers RCS116)	MAN0755
Color Touch OCS (e.g., OCSxxx)	MAN0465
OCS (Operator Control Station) (e.g., OCS1xx / 2xx; Graphic OCS250)	MAN0227
Remote Control Station (e.g., RCS2x0)	
MiniOCS (e.g., HE500OCSxxx, HE500RCSxxx)	MAN0305
Other Useful References	Manual Number
CAN Networks	MAN0799
Cscape Programming and Reference	MAN0313
Wiring Accessories and Spare Parts Manual	MAN0347

CHAPTER 3: MECHANICAL INSTALLATION

Note: Each XLe/XLt unit is sent with a datasheet in the box. **The datasheet is the first document you need to refer to for model-specific information related to XLe/XLt models such as pin-outs, jumper settings, and other key installation information.** The web version of this manual has all of the XLe/XLt datasheets attached to it. Visit our website (see page 83) to obtain datasheets, user documentation, and updates.

3.1 Overview

The mechanical installation greatly affects the operation, safety and appearance of the system. Information is provided to mechanically install the unit such as cut-out sizes, mounting procedures and other recommendations for the proper mechanical installation of the unit.

3.2 Mounting Requirements

XLe/XLt products can be mounted through a panel or on DIN rail.

3.2.1 Mounting Procedures (Installed in a Panel Door)

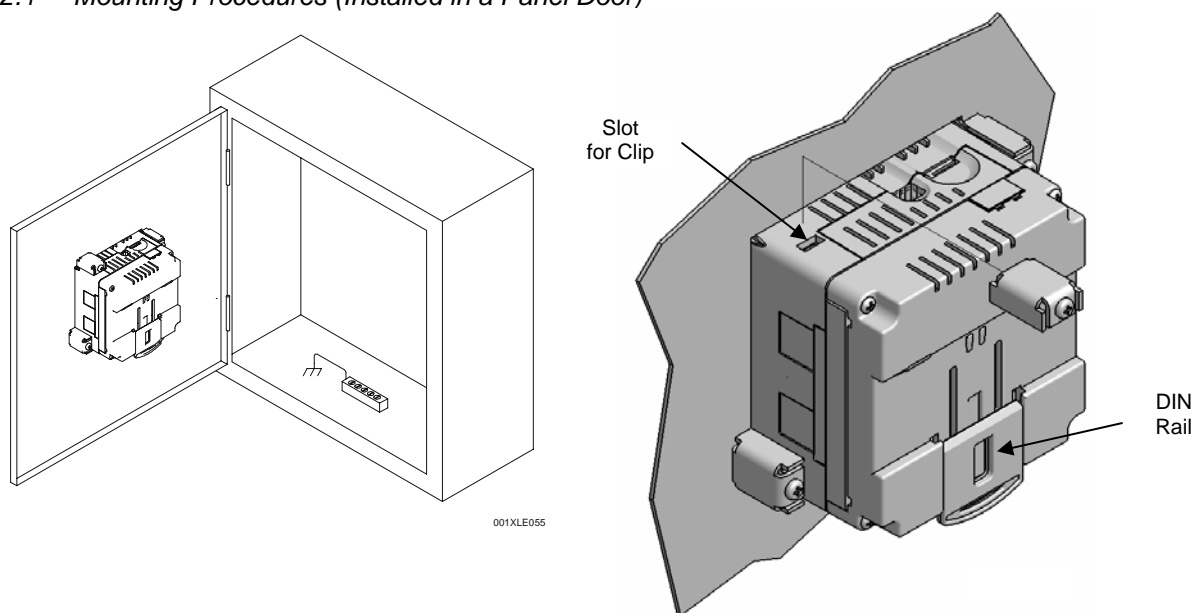


Figure 3.1 – Panel Mounting of the XLe/XLt and Close-up View of Back

Once the panel design has been completed using the criteria and suggestions in the following sections, use the following steps to panel mount the XLe/XLt.

1. Remove all connectors from the XLe/XLt unit.
2. Press the DIN rail clip up to make passing the unit through the cutout easier.
3. Make sure the gasket is installed on the XLe/XLt and is free from dust and debris. Check that the corners of the gasket are secure.
4. Pass the unit through the panel.
5. Insert the each of the four (4) mounting clips into the slots in the XLe/XLt case. One clip should be installed on each corner. Lightly tighten each screw so the clip is held in place.
6. Tighten the screws on the clips such that the gasket is compressed against the panel.

3.2.2 Mounting Procedures (Installed on DIN Rail)

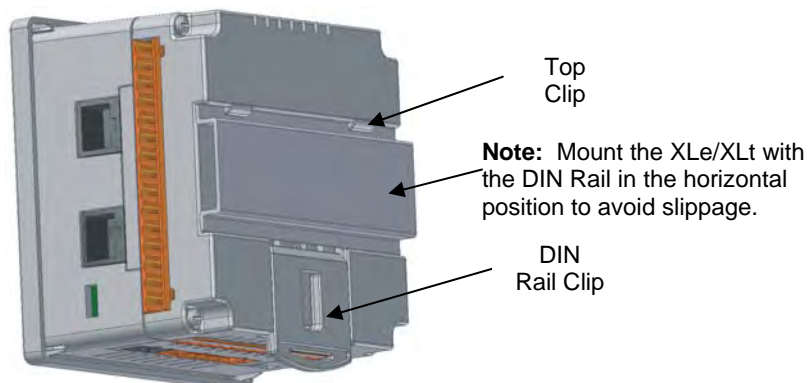


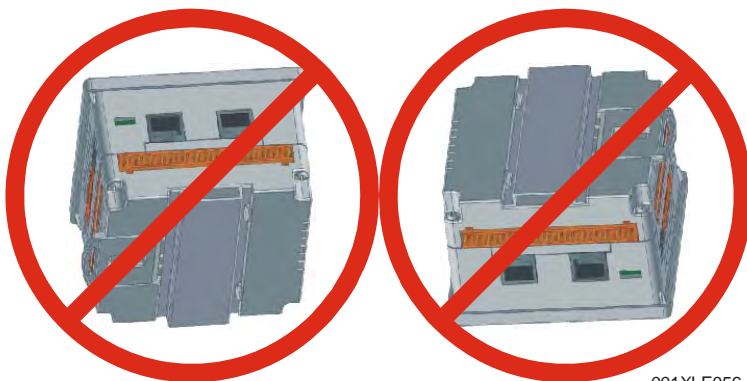
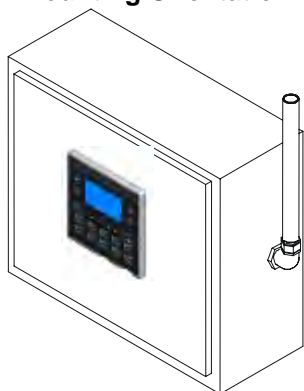
Figure 3.2 – DIN Rail Mounting of the XLe/XLt

The XLe/XLt is designed to clip onto standard 35 millimeter DIN rail. If your installation requires liquid or dust protection, make sure the XLe/XLt is placed in an appropriate sealed panel when mounting on DIN rail. Use the following steps to mount the XLe/XLt on DIN rail.

1. Move the DIN rail clip to the lower position.
2. Clip the “Top Clips” on the top of the DIN rail.
3. Press the unit into place and press the DIN rail clip up. A small flat-head screw driver can be used in the slot of the DIN rail clip if clearance is an issue.

Note: The DIN rail connection does not provide an earth ground. Refer to CHAPTER 4 for proper grounding information.

3.3 Mounting Orientation



001XLE056

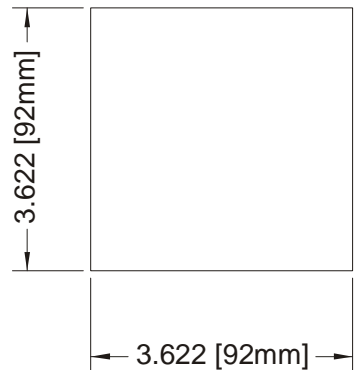
NOTE: For panel or DIN rail mounting:
The orientation shown above provides for optimum readability of the screen and ease of use of the keypad.

CAUTION: For DIN Rail mounting:
To prevent the unit from slipping off the DIN Rail, do not install the unit on its sides as shown. Be sure the DIN Rail is in the horizontal position. .

Figure 3.3 – Orientation of XLe/XLt OCS

3.4 Panel Cut-Out

For installations requiring NEMA4X liquid and dust protection the panel cutout should be cut with a tolerance of $\pm 0.005"$ (0.1 mm). The XLe/XLt is designed to fit ¼ DIN panel openings. There are a number of punches and enclosures designed to accommodate opening of this size.



001XLE002

Figure 3.4 – XLe/XLt Panel Cut-out

3.5 Dimensions

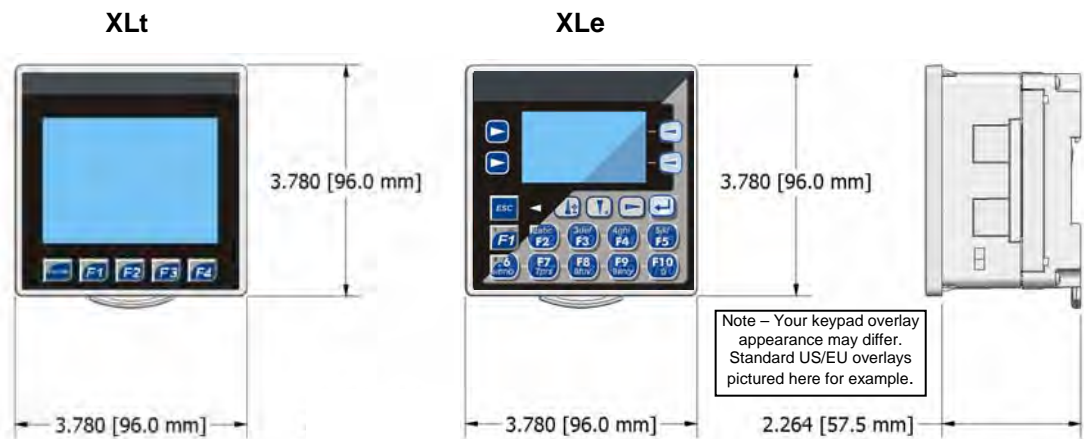


Figure 3.5 – XLe/XLt Dimensions

Note: When the communication add-on modules are installed such as Ethernet or Modem the depth of the product increases from 2.264 (57.5 mm) to 2.68 (68 mm).

3.6 Factors Affecting Panel Layout Design and Clearances

Warning: It is important to follow the requirements of the panel manufacturer and to follow all applicable electrical codes and standards.

The designer of a panel layout needs to assess the requirements of a particular system and to consider the following design factors. *A convenient checklist is provided on page 19.*

3.6.1 Clearance / Adequate Space

Install devices to allow sufficient clearance to open and close the panel door.

Table 3.1 – Minimum Clearance Requirements for Panel Box and Door	
Minimum Distance between base of device and sides of cabinet	2 inches (50.80mm)
Minimum Distance between base of device and wiring ducts	1.5 inches (38.10mm)
<u>If more than one device installed in panel box (or on door):</u> Minimum Distance between bases of each device	4 inches between bases of each device (101.60mm)
<u>When door is closed:</u> Minimum distance between device and closed door (Be sure to allow enough depth for XLe/XLt.)	2 inches (50.80mm)

3.6.2 Grounding

Warning: Be sure to meet the ground requirements of the panel manufacturer and also meet applicable electrical codes and standards.

Panel box: The panel box needs to be properly connected to earth ground to provide a good common ground reference.

Panel door: Tie a low impedance ground strap between the panel box and the panel door to ensure that they have the same ground reference.

3.6.3 Temperature / Ventilation

Ensure that the panel layout design allows for adequate ventilation and maintains the specified ambient temperature range. Consider the impact on the design of the panel layout if operating at the extreme ends of the ambient temperature range. For example, if it is determined that a cooling device is required, allow adequate space and clearances for the device in the panel box or on the panel door.

3.6.4 *Orientation*

When panel-mounted, there are no orientation restrictions on the XLe/XLt. However, the orientation shown in Figure 3.3 provides for optimum readability of the screen and ease of use of the keypad. When DIN Rail mounted, observe the orientation shown in Figure 3.2.

3.6.5 *Noise*

Consider the impact on the panel layout design and clearance requirements if noise suppression devices are needed. Be sure to maintain an adequate distance between the XLe/XLt and noisy devices such as relays, motor starters, etc.

3.6.6 *Shock and Vibration*

The XLe/XLt has been designed to operate in typical industrial environments that may inflict some shock and vibration on the unit. For applications that may inflict excessive shock and vibration please use proper dampening techniques or relocate the XLe/XLt to a location that minimizes shock and/or vibration.

3.6.7 *Panel Layout Design and Clearance Checklist*

The following list provides highlights of panel layout design factors.

- ___ Meets the electrical code and applicable standards for proper grounding, etc.?
- ___ Meets the panel manufacturer's requirements for grounding, etc.?
- ___ Is the panel box properly connected to earth ground? Is the panel door properly grounded? Has the appropriate procedure been followed to properly ground the devices in the panel box and on the panel door?
- ___ Are minimum clearance requirements met? (See **Table 3.1.**) Can the panel door be easily opened and closed? Is there adequate space between device bases as well as the sides of the panel and wiring ducts?
- ___ Is the panel box deep enough to accommodate the XLe/XLt?
- ___ Is there adequate ventilation? Is the ambient temperature range maintained? Are cooling or heating devices required?
- ___ Are noise suppression devices or isolation transformers required? Is there adequate distance between the base of the XLe/XLt and noisy devices such as relays or motor starters? Ensure that power and signal wires are not routed in the same conduit.
- ___ Are there other requirements that impact the particular system, which need to be considered?

NOTES

CHAPTER 4: ELECTRICAL INSTALLATION

Note: Each XLe/XLt unit is sent with a datasheet in the box. **The datasheet is the first document you need to refer to for model-specific information related to XLe/XLt models such as pin-outs, jumper settings, and other key installation information.** The web version of this manual has all of the XLe/XLt datasheets attached to it. Visit our website (see page 83) to obtain datasheets, user documentation, and updates.

4.1 Grounding Definition

Ground: The term **Ground** is defined as a conductive connection between a circuit or piece of equipment and the earth. Grounds are fundamentally used to protect an application from harmful interference causing either physical damage such as by lightning or voltage transients or from circuit disruption often caused by radio frequency interference (RFI).

4.2 Ground Specifications

Ideally, a ground resistance measurement from equipment to earth ground is 0 ohms. In reality it typically is higher. The U.S. National Electrical Code (NEC) states the resistance to ground shall not exceed 25 ohms. Horner APG recommends less than 15 ohms resistance from our equipment to ground. Resistance greater than 25 ohms can cause undesirable or harmful interference to the device.

4.3 How to Test for Good Ground

In order to test ground resistance, a Ground Resistance Tester must be used. A typical Ground Resistance Meter Kit contains a meter, two or three wire leads, and two ground rods. Instructions are supplied for either a two-point or three-point ground test. **Figure 4.1** shows a two-point ground connection test.

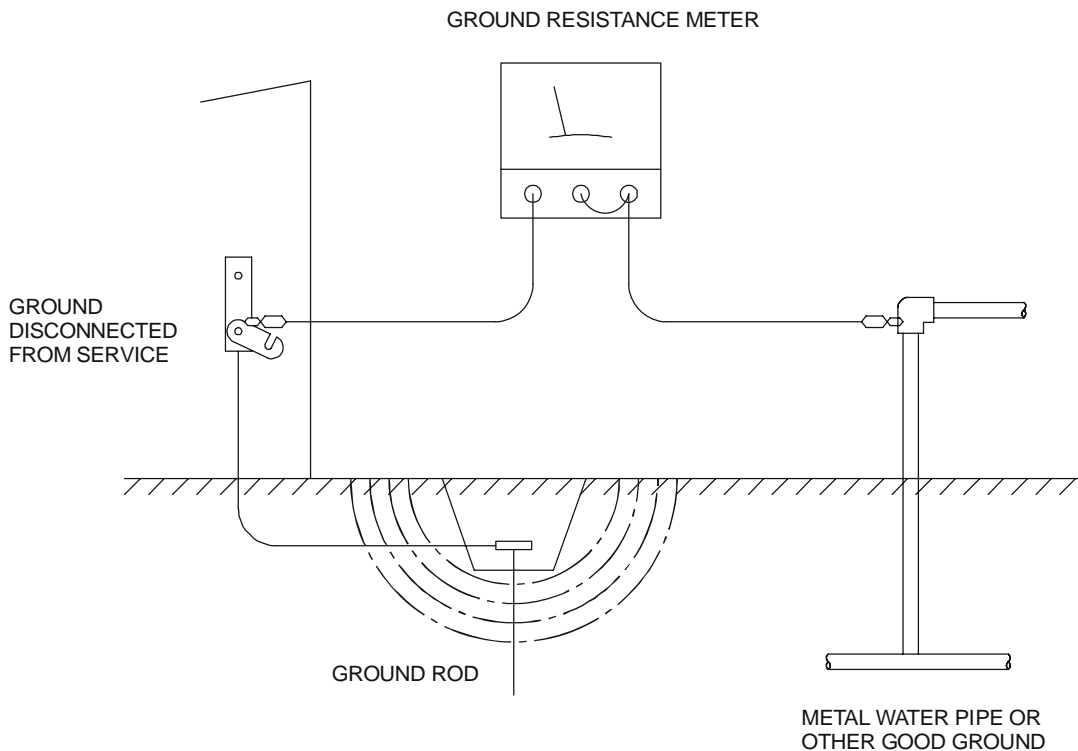



Figure 4.1 - Two-Point Ground Connection Test

4.4 Primary Power Port

Table 4.1 – Primary Power Port Pins		
Pin	Signal	Description
1		Frame Ground
2	0V	Input power supply ground
3	+24V	Input power supply positive voltage

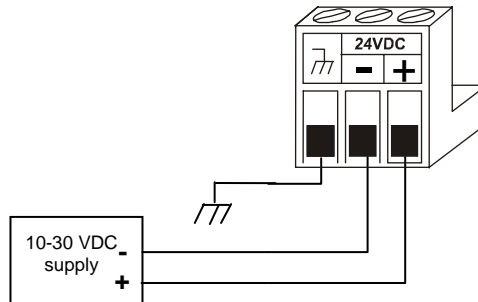


Figure 4.2 - Power Connector (Primary Power Port)

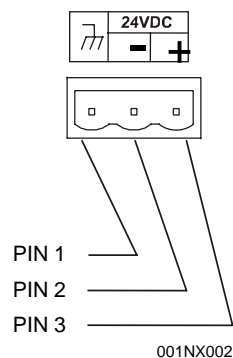


Figure 4.3 - As Viewed Looking at the XLe/XLt

Power Connector

Power Up:
Connect to Earth Ground.
Apply 10 – 30 VDC.
Screen lights up.
Torque rating 4.5 - 7 Lb-In
(0.50 – 0.78 N-m)

CHAPTER 5: SERIAL COMMUNICATIONS

5.1 Overview

All XLe/XLt models provide two serial ports, which are implemented with 8-pin modular RJ45 connectors, and are labeled **MJ1** and **MJ2**. The MJ1 serial port is normally used for XLe/XLt programming by connecting it to the COM port of a PC running Cscope. In addition, both MJ1 and MJ2 can be used for application-specific communication, using a variety of standard data exchange protocols.

5.2 Port Descriptions

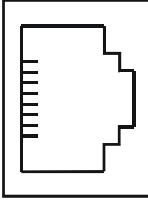
The MJ1 serial port contains both a half-duplex RS-485 interface and an RS-232 interface with RTS/CTS handshaking. **Note: MJ1 shares its serial port with the optional COM module, so when an optional Ethernet or Modem COM module is installed and active, the MJ1 connector is inactive.**

The MJ2 serial port contains both a full-duplex RS-485 interface and an RS-232 interface with no handshaking. Both the MJ1 and MJ2 RS-485 interfaces provide switchable termination and bias resistors internally.

5.3 Wiring

Figure 5.1 along with **Table 5.1** and **Table 5.2** show how the MJ1 and MJ2 serial port pins are assigned.

Note: MJ1 and MJ2 look the same but have different pin assignments and functions.



Pin	MJ1 Pins		MJ2 Pins	
	Signal	Direction	Signal	Direction
8	TXD	OUT	TXD	OUT
7	RXD	IN	RXD	IN
6	0 V	Ground	0 V	Ground
5*	+5 60mA	OUT	+5 60mA	OUT
4	RTS	OUT	TX-	OUT
3	CTS	IN	TX+	OUT
2	RX- / TX-	IN / OUT	TX-/RX-	IN
1	RX+ / TX+	IN / OUT	TX+/RX+	IN

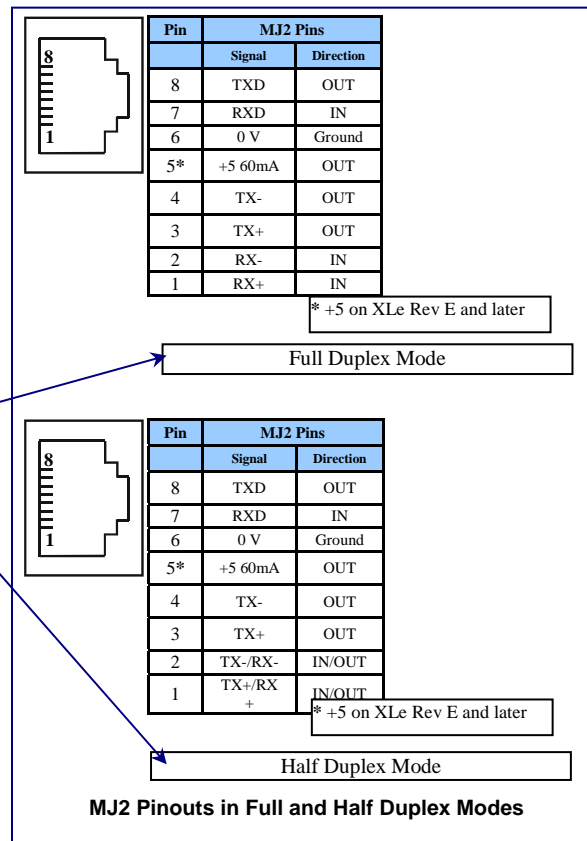
Figure 5.1 – MJ Serial Port Connector

Table 5.1 – MJ1 Serial Port Pin Assignments			
Pin	Signal	Signal Description	Direction
1	RX/TX+	RS-485 Receive/Transmit Positive	In/Out
2	RX/TX-	RS-485 Receive/Transmit Negative	In/Out
3	CTS ¹	RS-232 Clear to Send	Out
4	RTS ¹	RS-232 Request to Send	In
5	+5*	+5 Vdc 60mA max	Out
6	0V	Ground	–
7	TD ¹	RS-232 Transmit Data	In
8	RD ¹	RS-232 Receive Data	Out

- * +5 on XLe Rev E and later
- * +5 on all revisions XLt

Table 5.2 – MJ2 Serial Port Pin Assignments			
Pin	Signal	Signal Description	Direction
1	RX+	RS-485 Receive Positive	In
2	RX-	RS-485 Receive Negative	In
3	TX+	RS-485 Transmit Positive	Out
4	TX-	RS-485 Transmit Negative	Out
5	+5*	+5 Vdc 60mA max	Out
6	0V	Ground	–
7	TD ¹	RS-232 Transmit Data	In
8	RD ¹	RS-232 Receive Data	Out

¹ Signals are labeled for connection to a DTE device



5.4 RS-485 Termination

Proper RS-485 termination minimizes reflections and improves reliability.

Both serial ports allow an internal 121-Ohm RS-485 termination resistor to be placed across pins 1 and 2. This can be done by installing a jumper. Please refer to the XLe/XLt data sheet for jumper locations.

In any case, only the two devices physically located at the endpoints of the RS-485 network should be terminated.

5.5 RS-485 Biasing

RS-485 biasing passively asserts a line-idle state when no device is actively transmitting, which is useful for multi-drop RS-485 networking.

Both serial ports allow internal 390-Ohm RS-485 bias resistors to be switched in, pulling pin 1 up to 3.3V and pulling pin 2 down to ground. The Set Serial Ports item in the System Menu (see page 51) can be used to enable RS-485 biasing. Also, an application graphics screen that writes to %SR164 can do the same thing. Setting %SR164.1 enables MJ1 biasing and setting %SR164.2 enables MJ2 biasing.

If biasing is used, it should be enabled in only one of the devices attached to the RS-485 network.

5.6 Cscape Programming via Serial Port

The XLe/XLt MJ1 serial port supports CsCAN Programming Protocol, but MJ2 does not. If a PC COM port is connected to the XLe/XLt MJ1 serial port, Cscape can access the XLe/XLt for programming and monitoring.

5.7 Ladder-Controlled Serial Communication

Using Serial Communication function blocks, both MJ1 and MJ2 support Generic, Modbus Master and Modbus Slave Protocols. In addition, external modems can be connected and accessed using Init, Dial and Answer Modem function blocks.

5.8 Downloadable Serial Communication Protocols

Both MJ1 and MJ2 also support downloadable protocols, such as Allen Bradley DF1, CsCAN Master, GE Fanuc SNP and Modbus Master.

CHAPTER 6: CAN COMMUNICATIONS

Note: For additional CAN information, refer to the CAN Networks manual (MAN0799) on our website. (See page **83** for our website address.)

6.1 Overview

Some XLe/XLt models (XE1xx) provide a CAN networking port, which is implemented with a 5-pin connector, labeled **NET1**.

Like the MJ1 serial port, the NET1 port can be used for XLe/XLt programming by connecting it to the CAN port of a PC running Cscope. The NET1 port also allows the XLe/XLt to exchange global data with other OCS/RCS controllers and to access remote Network I/O devices (SmartStix Modules).

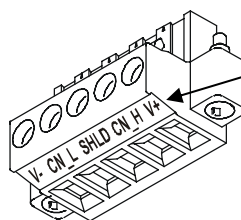
6.2 Port Description

The XLe/XLt NET1 port implements the ISO 11898-2 physical layer and the CAN 2.0A data link layer standards. Also, since the NET1 port is powered by an internal isolated power supply, external CAN power is not required.

6.3 Wiring

Figure 6.1 and **Table 6.1** show how the NET1 port pins are assigned.

CAN Connector
Use the CAN Connector
when using CsCAN network.
Torque rating 4.5 – 7 Lb-In
(0.50 – 0.78 N-m)



Note: The V+ connection is not required on the XLe/XLt. The XLe/XLt network port is self-powered. Supporting devices can require this connection, and this pin can be used to land the extra wire required for those devices.

Figure 6.1 - NET1 Port Connector

Table 6.1 – NET1 Port Pin Assignments			
Pin	Signal	Signal Description	Direction
1	V-	CAN Ground	–
2	CN_L	CAN Data Low	In/Out
3	SHLD	Shield Ground	–
4	CN_H	CAN Data High	In/Out
5	NC	No Connect	–

6.4 Cscape Programming via CAN

The NET1 port supports CsCAN Programming Protocol. If a PC has a CAN interface installed (via PCI card or USB), and the PC CAN port is connected to the XLe/XLt NET1 port, Cscape can access the XLe/XLt for programming and monitoring.

In addition, the XLe/XLt supports single-point-programming of all XLe/XLt and other OCS/RCS devices that are connected to a CAN network. If the PC COM port is connected to the XLe/XLt MJ1 serial port (see CHAPTER 5), the XLe/XLt can act as a pass-through gateway allowing Cscape to access all XLe/XLt and OCS/RCS devices that are attached to the CAN network.

6.5 Ladder-Controlled CAN Communication

Using Put and Get Network Words function blocks, the NET1 port can exchange digital and analog global data with other XLe/XLt or OCS/RCS devices (nodes) attached to the CAN network.

In addition, Put and Get Network Heartbeat function blocks allow nodes on the CAN network to regularly announce their presence and to detect the presence (or absence) of other nodes on the network.

6.6 Using CAN for I/O Expansion (Network I/O)

Connecting Network I/O devices (SmartStix Modules) to the XLe/XLt NET1 port, allows the XLe/XLt I/O to be economically expanded and distributed. A variety of SmartStix Modules is available for this purpose.

CHAPTER 7: COMMUNICATION OPTIONS

7.1 Overview

To supplement the built-in MJ1 and MJ2 serial ports (see CHAPTER 5), additional communication options are available. This is accomplished by installing a COM module internal to the XLe/XLt controller. Currently, there are two COM modules available for this purpose: Ethernet (XEC) and Modem (XMC).

7.1.1 MJ1 shares its serial port with the optional COM module, so when an Ethernet or Modem COM module is installed and active, the MJ1 connector is inactive.

Internal to the XLe/XLt, there is a CPU board, and up to two installed modules. Models XE000/XT000 and XE100/XT100 have no installed I/O or COM modules. All other models have an I/O module in Slot 1 and can have a user-installed COM module in Slot 2.

This chapter briefly describes both the Ethernet and Modem COM module options. For detailed information regarding these modules, please refer to the individual documents provided with the modules.

7.2 Ethernet COM Module (XEC) Option

An Ethernet COM module can be installed to allow Cscape programming of an XLe/XLt over a Local Area Network or over the Internet. In addition, the Horner OPC Server can be installed on a PC to allow other standard PC applications (such as database and spreadsheets programs) access to XLe/XLt register data.

The Ethernet COM module supports both 10 BaseT (10 MHz) and 100 BaseTx (100 MHz) as well as both half and full duplex communication. Both the connection speed and the duplex are auto-negotiated.

Although the physical connection between the Ethernet COM Module and the Local Area Network is done using a standard Ethernet cable (CAT5 or better with RJ45 modular plug), a **Serial Port Tunnel** protocol is employed that makes the Ethernet COM Module appear as a serial port to Cscape or OPC Server software running on the PC.

On the XLe/XLt end of the Serial Port Tunnel, the Ethernet COM module should be properly configured using the XLe/XLt System Menu (see CHAPTER 11). This configuration consists of making Ethernet the Default Programming Port and setting its target IP Address, Net Mask and optionally the Gateway IP Address. The Gateway IP Address is required if the XLe/XLt will be accessed from outside the Local Area Network (e.g. the Internet).

On the PC end of the Serial Port Tunnel, the PC should be connected to the Local Area Network (or to the Internet) and a **Com Port Redirector** driver must be installed on the PC and properly configured. The Com Port Redirector allows multiple "virtual" PC serial ports to be created and each one can be assigned to a different target device IP Address, thus allowing access to Ethernet COM modules in multiple XLe/XLt controllers.

After installing and configuring both the Ethernet COM module and the Com Port Redirector, Cscape or OPC Server software should be set up to communicate to one of the "virtual" serial ports, at which point they should function as if a "real" PC serial port was connected to the XLe/XLt MJ1 serial port.

7.3 Modem COM Module (XMC) Option

A Modem COM module can be installed to allow Cscape programming of an XLe/XLt over a dial-up network. In addition, the application ladder program can take control of the modem for application-specific modem communication.

The Modem COM module supports the standard AT command set and can connect to the dial-up network at speeds up to 14.4 KBaud. Connection speed is auto-negotiated. The Modem COM module connects to the dial-up network (phone line) via a cable with a standard RJ11 modular plug.

To enable Cscape programming via a dial-up network, the Modem COM module should first be configured as the Default Programming Port, using the XLe/XLt System Menu (see CHAPTER 11). Doing this puts the Modem COM module in auto-answer mode, so Cscape can call the XLe/XLt via a remote modem.

To program the ladder application to communicate via the Modem COM module, standard Cscape Serial and Modem function blocks can be used.

CHAPTER 8: REMOVABLE MEDIA

8.1 Overview

All XLe/XLt models provide a Removable Media slot, labeled **Memory**, which supports standard Micro SD Flash memory cards. Micro SD cards can be used to save and load applications, to capture graphics screens and to log data for later retrieval.

8.2 Micro SD Cards

When the Micro SD card format was introduced, it was originally called TransFlash. Cards labeled either Micro SD or TransFlash, with up to 2.0 GB of Flash memory, are compatible with the XLe/XLt Memory slot.

The XLe/XLt Memory slot is equipped with a “push-in, push-out” connector and a Micro SD card can be safely inserted into the Memory slot whether the XLe/XLt power is On or Off.

To install a Micro SD card: Align its 8-pin gold edge connector down, facing the front of the XLe/XLt unit as shown in **Figure 8.1**; then carefully push it all the way into the Memory slot. Ensure that it clicks into place.

To remove the Micro SD card: Push down on the top of the card gently to release the spring. The card pops up for removal.

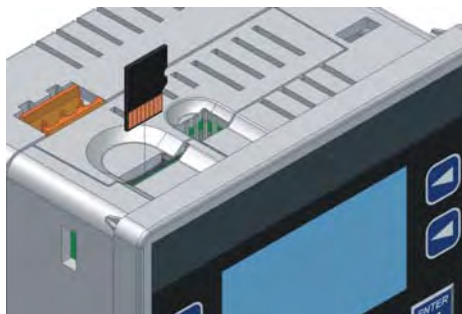


Figure 8.1 – Installing Removable Memory Card

8.3 Micro SD File System

The XLe/XLt Micro SD Memory slot uses the PC-compatible FAT16 File System. This means that a PC, with a Micro SD-compatible card reader, can read files that have been written by the XLe/XLt and can write files that can be read by the XLe/XLt.

However, the XLe/XLt does not support long filenames, but instead implements the 8.3 filename format. This means that all file and directory names must consist of up to 8 characters, followed by an optional dot, and an optional extension with up to 3 characters.

Directories and sub-directories can be nested up to 16 levels deep as long as each pathname string does not exceed 147 characters.

8.4 Using the Removable Media Manager

The Removable Media Manager is an interactive XLe/XLt screen that performs the following functions:

- Display number of total and free bytes
- Browse file and directory lists
- Delete files and directories
- Format a Micro SD card
- Load and save application programs
- View screen capture bitmaps

The Removable Media Manager can be accessed via the System Menu (see CHAPTER 11) or by using Cscape to place a Removable Media Manager object on an application graphics screen.

8.5 Using Removable Media to Log Data


Using Read and Write Removable Media function blocks, an application ladder program can read and write XLe/XLt register data in the form of comma-delimited files, with a .CSV extension. These files are compatible with standard database and spreadsheet PC programs. In addition, an application ladder program can use Rename and Delete Removable Media function blocks to rename and delete files.

8.6 Using Removable Media to Load and Save Applications

A special file type, with a .PGM extension, is used to store XLe/XLt application programs on Micro SD.

To load an application from Micro SD to the XLe/XLt, use the Removable Media Manager to find and highlight the desired .PGM file, and then press **Enter**.

To save an application from the **XLe** to Micro SD, open the Removable Media Manager in the System Menu and press the F4 function key. The application will be saved in a file called **DEFAULT.PGM** in the Micro SD root directory.

To save an application from the **XLt** to Micro SD, open the Removable Media Manager in System Menu and press the **Save Pgm**  soft key displayed at the bottom of the XLt's touch screen. The application will be saved in a file called **DEFAULT.PGM** in the Micro SD root directory.

Note: Saving an application to Micro SD can only be done from the System Menu and is not available on a Removable Media Manager object that was placed on an application graphics screen by Cscape.

Cscape can also save an application directly to a Micro SD card, which is plugged into the PC's Micro SD compatible card reader by selecting the Export to Removable Media item on the **File** menu.

8.7 Using Removable Media to View and Capture Screens

The XLe/XLt File System uses bitmap files with the .BMP (.bmp) extension to store XLe/XLt graphic screen captures.

To view a captured XLe/XLt screen, use the Removable Media Manager to find and highlight the desired .BMP file, and then press **Enter**.

To capture an XLe/XLt screen, turning On the assigned **Screen Capture Control Register** will capture the current XLe/XLt graphics screen and write it to the Micro SD card using the assigned **Screen Capture Filename**.

Before capturing an XLe/XLt screen, Cscape must first be used to assign a **Screen Capture Control Register** and **Filename** in the application. To do this, first open the Graphics Editor by selecting the **View / Edit Screens** item on the Cscape **Screens** menu. Next select the **Screen Capture** item of the Graphics Editor Config menu and then enter a **Control Register** and **Filename**.

NOTES

CHAPTER 9: GENERAL I/O

Note: Each XLe/XLt unit is sent with a datasheet in the box. The datasheet is the first document you need to refer to for model-specific information related to XLe/XLt models such as pin-outs, jumper settings, and other key installation information. The web version of this manual has all of the XLe/XLt datasheets attached to it. Visit our website (see page 83) to obtain datasheets, user documentation, and updates.

9.1 Overview

The XLe/XLt is a compact unit that contains high density, very versatile I/O. Using the I/O properly requires wiring to the proper terminals, configuring jumpers inside the XLe/XLt unit and configuring Cscape properly. This section will offer some tips and suggestions to configure the I/O properly. For the register mapping of the I/O, refer to CHAPTER 13.

9.2 Removing the XLe/XLt Back Cover

Warning: Power, including I/O power *must be removed* from the unit prior to removing the back cover. Failure to do so could result in electrocution and/or damage to equipment.

Some I/O configurations require jumper settings to be changed inside the XLe/XLt unit. Examples of these settings are setting positive or negative logic on digital inputs or setting current or voltage on analog inputs.

Each XLe/XLt I/O jumper is set to a factory default. Refer to the data sheet for your XLe/XLt model to find the default setting to determine if a jumper change is necessary for your application.

To remove the back cover of the XLe/XLt, remove the four (4) Phillips screws from the back of the unit. It may help to place the XLe/XLt unit face down on a clean work surface. Once the four screws are removed the back cover can be lifted straight off.

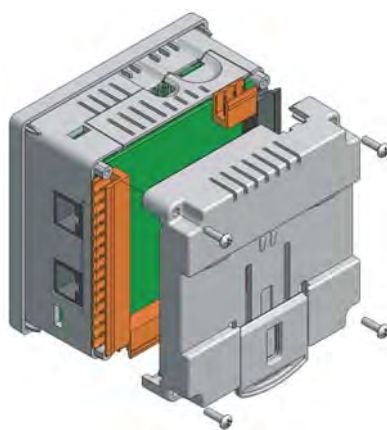


Figure 9.1 – Removing the Back Cover

Once the back is removed the jumper selection can be changed. The jumper settings are documented on each data sheet using a diagram such as Figure 9.2 below and a description of the jumper settings.

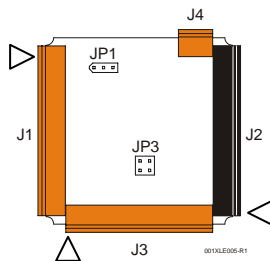


Figure 9.2 – Example Jumper Diagram

To re-install the back cover, place the cover back on the unit. The DIN clip should be on the same side as the power connector.

Place the screw back into the hole and turn the screw slowly counter clockwise until it clicks into the threads. This prevents the screw from being cross-threaded. Now turn the screw clock-wise until the cover is firmly secured. Repeat this process for all four (4) screws.

9.3 Model and I/O Overview

Table 9.1 – I/O and Model Overview						
Model (XLe or XLt)	Solid State Digital Outputs	Relay Outputs	Digital Inputs	Analog Inputs	Universal Analog Inputs	Analog Outputs
HEXxxx0						
HEXxxx2		✓	✓	✓		
HEXxxx3	✓		✓	✓		
HEXxxx4	✓		✓	✓		
HEXxxx5	✓		✓		✓	✓

Table 9.1 shows the different types of I/O included with the various XLe/XLt models. Specific specifications, jumper settings and wiring diagrams can be found on the data sheets attached at the end of the manual. Descriptions and applications of the different type of I/O can be found below.

9.4 Solid-State Digital Outputs

Solid-state digital outputs are generally used to activate lamps, low voltage solenoids, relays and other low voltage and low current devices.

Note: The digital outputs used on the XLe/XLt are “sourcing” outputs. This means the output applies a positive voltage to the output pin when turned ON. When turned off, the output applies approximately zero volts with respect to the I/O ground.

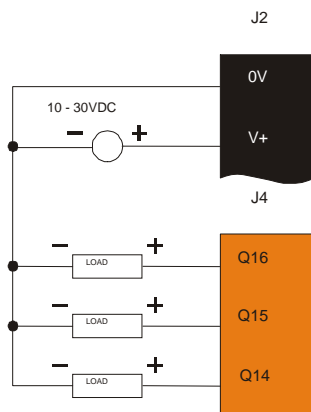


Figure 9.3 – Typical Output Wiring

The digital outputs used in the XLe/XLt have electronic short circuit protection and current limiting. While these electronic protections work in most applications, some application may require external fusing on these outputs.

The digital outputs in the XLe/XLt are typically controlled via %Q bits in the register mapping. Some of the outputs are designed for high-speed applications and can be used for PWM or frequency output applications. Please see the data sheet and the chapter on High Speed I/O for additional information.

When the controller is stopped the operation of each output is configurable. The outputs can hold the state they were in before the controller stopped or they can go to a predetermined state. By default digital outputs turn off. For more information on stop state see configuration (Chapter 14) for Cscape settings.

The digital outputs feature an output fault bit. %I32 will turn on if any of the outputs experience a short circuit, over-current or the output driver overheats.

9.5 Relay Outputs

Relay outputs are designed to switch loads that typically have high voltage or current requirements or require isolation that relays provide.

Note: The design of the XLe/XLt does not require external coil power for the relays to function. The relays will activate anytime the XLe/XLt is powered.

There are several factors that should be considered when using relays.

Relay Life – Relays are mechanical devices that have a long but limited life. Typically switching more current limits the life of relays. Please check the data sheets at the end of this manual for expected relay life.

Current / Temperature De-Rating – Products containing relays often have total current limits based on the ambient temperature of the application. Please see the product data sheet for current / temperature de-rating information for relays.

Fusing – External fusing is generally required to protect the relays, devices and wiring from shorts or overloads.

Warning: To protect the module and associated wiring from load faults, use external (**5 A**) fuse(s) as shown. Fuses of lower current or fusing for the entire system need to be in place to assure the maximum current rating of the unit is not exceeded.

Warning: Connecting high voltage to any I/O pin can cause high voltage to appear at other I/O pins.

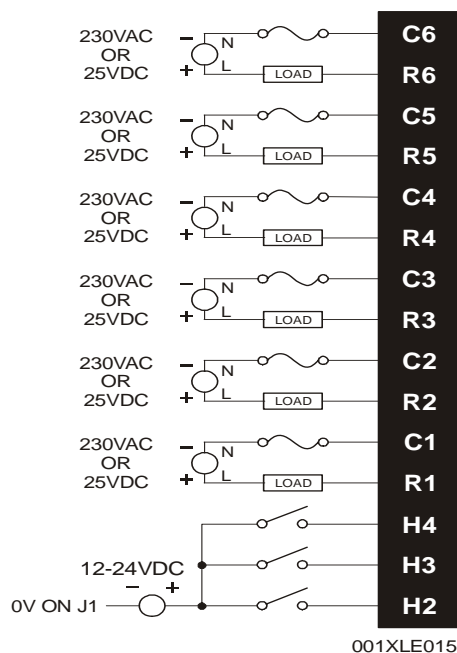


Figure 9.4 - Relay Fusing

Protection for Inductive Loads – Inductive loads can cause reverse currents when they shut off that can shorten the life of relay contacts. Some protective measures need to be determined by an engineer. Below you will find recommendations that will work for many applications. If you have additional questions on protection from inductive load, consult an application engineer or HEAPG Technical Support.

DC Loads – General purpose diode (IN4004) in reverse bias across the load.

AC Load – MOV (Harris V140xxx for 120V, V275xx for 220V)

Output State on Controller Stop

When the controller is stopped the operation of each output is configurable. The outputs can hold the state they were in before the controller stopped or they can go to a predetermined state. By default relay outputs turn off. For more information on stop state see configuration (Chapter 14) for Cscape settings.

9.6 Digital Inputs

Note: See CHAPTER 10 for high speed I/O information and refer to the datasheet for XLe/XLt model you are using for details on jumper settings.

Note: The digital inputs on the XLe/XLt are designed for low voltage DC inputs. The inputs are designed to support both positive and negative input modes. The mode is set by a jumper setting and a configuration parameter in Cscape. All the inputs on the unit must be configured to the same mode.

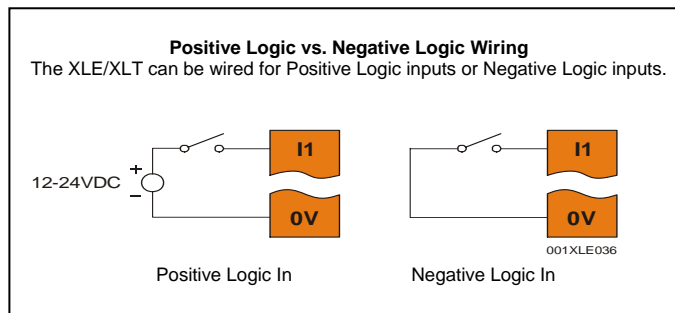


Figure 9.5 – Positive and Negative Inputs

In positive logic mode a positive voltage applied to the input will turn the input. The internal design of this mode is basically a resistor from the input to I/O ground. This mode is sometimes called sourcing.

In negative logic mode, connecting the input to the I/O ground or zero volts will turn the input on. The internal design of this mode is basically a resistor from the input to the positive I/O voltage (usually 12 or 24 volts). This mode is sometime called sinking.

Some of the digital inputs may support high speed input functional such as counting or frequency measurement.

9.7 Analog Inputs

Note: See the data sheet for the XLe/XLt model you are using for jumper settings and CHAPTER 14 for details on how to use Cscape to configure the digital filtering.

The analog inputs on the XLe/XLt allow voltage or current measurement from a variety of devices. The voltage or current mode is set though jumpers on the unit and settings in Cscape. Each channel can be separately configured for voltage or current mode.

The analog inputs have a digital filter that can be used to filter electrical noise that may be unavoidable in some installations. The downside to digital filtering is the inputs will respond more slowly to sudden changes in the actual input.

9.8 Universal Analog Inputs

Note: See the data sheet for the XLe/XLt model you are using for jumper settings and CHAPTER 14 for details on how to use Cscape to configure the digital filtering.

The universal analog inputs provide a high resolution, very flexible interface for a variety of analog inputs. These inputs include voltage, current, thermocouple, RTD and millivolt. Each channel can be configured separately using jumpers and configuration settings in Cscape.

Like the standard analog inputs, these inputs have a digital filter that can be used to filter electrical noise that may be unavoidable in some installations. The downside to digital filtering is the inputs will respond more slowly to sudden changes in the actual input.

9.9 Analog Outputs

Note: See CHAPTER 10 for high speed I/O information and refer to the datasheet for XLe/XLt model you are using for details on jumper settings.

The analog outputs on XLe/XLt devices provide high resolution voltage or current outputs. The voltage or current selection is controlled with jumpers and configuration settings in Cscape. Note that each channel can be separately configured for voltage or current mode.

When the controller is stopped the operation of each output is configurable. The outputs can hold the state they were in before the controller stopped or they can go to a predetermined value. By default analog outputs are set to a value of zero. For more information on Stop State, see CHAPTER 14 for the configuration chapter for Cscape settings.

CHAPTER 10: HIGH SPEED I/O (HSC / PWM)

10.1 Overview

In addition to the compliment of simple analog and digital I/O, several of the XLe/XLt I/O modules support High Speed Counting (HSC) I/O functions and may also support Pulse Width Modulation (PWM) Output functions. The HSC functions include: frequency, totalizing, pulse width and quadrature measurement. The PWM functions include: traditional PWM (with variable rate and duty) and a stepper (limited functionality) with variable acceleration and deceleration rates. To determine function availability, refer to the associated model's Specification/Installation sheet (Digital DC Input/Output sections).

This chapter describes the operation of these high level I/O functions. For configuration details of these functions, see Cscape Configuration (page 70).

10.2 High Speed Counter (HSC) Functions

On units that support the HSC, four dedicated inputs are available than can be configured for one of four modes of operation. Those modes are Frequency, Count (totalize), Pulse width or period (pulse) and Quadrature measurement. For some modes, more than one HSC input may be consumed. The measurement value is provided to ladder in a %AI register (see mapping below).

Note that while the high-speed input circuitry has a resolution of 1 μ s, measured edge transitions must not occur faster than 100 μ s for accurate measurements. Keep in mind that pulse width measurements utilize both the rising and falling edges of the waveform, thus the pulse width must exist longer than 100 μ s.

Note that the edge polarity selection in the mode parameter for the totalize and pulse width functions (Digital/HSC Input Configuration) assume Positive Logic regardless of the associated I/O board's jumper setting for the *Digital DC inputs polarity*. If Negative logic is configured when using these functions, the opposite edge polarity must be selected in the mode parameter.

10.2.1 Frequency

In frequency mode, the frequency of the input signal is written to the accumulator in terms of Hertz (cycles/second). When using frequency mode, four update selections are provided which specify the width of the sample window. Note that selecting a shorter sample window provides a quicker measurement (faster response) but lowers the frequency accuracy (resolution) and increases the minimum frequency measurement limit.

10.2.2 Totalize

In totalize mode, the accumulator is simply incremented each time the input transitions in a specific direction. Totalize mode is configurable to specify the edge (rising or falling) on which the accumulator is incremented.



Three different options are available to reset the current count. They are:

- **Configured reset value**
When configuring the Totalize function, a value may be specified under the *Counts per Rev* column. When the totalizer accumulator reaches this value - 1, the accumulator will reset to zero on the next count. Specifying zero for this value allows the totalizer to count through the full 32-bit range before resetting.
- **Ladder control**
Setting registers %Q17-20 reset HSC1-4 (respectively) with no additional configuration. When these registers are asserted, the associated totalizer accumulator is reset and held at zero (level sensitive). *See also Section 10.6.*
- **Direct digital input control (HSC1 and HSC2 only)**
HSC3 (%I11) and HSC4 (%I12) may be configured as hardware digital reset signals for HSC1 and HSC2 (respectively). To enable these inputs as reset signals, specify the type as *Totalize Reset* (note that the corresponding Totalize HSC must be previously configured before this option is available). The direct digital reset controls are edge sensitive with the edge polarity configurable.

Maximum direct digital reset latency is 100 μ s.

The totalize function also supports an option which compares the current accumulator value with a supplied Preset Value (PV), which is provided through a %AQ, and drives a physical digital output based on the that comparison.

- This option (available for HSC1 and HSC2 only) drives Q1 or Q2 output point (respectively) once the associated totalizer accumulator reaches (or exceeds) the PV value. To enable this function, the corresponding PWM function output (Q1 or Q2) must be configured for *HSCx Output*.

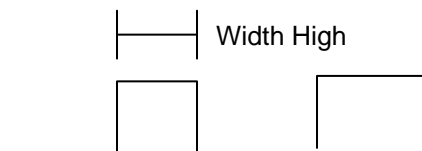
Note that Q1 and Q2 are PWM function outputs that may be configured independently as one of the following: standard digital output, PWM, HSCx or stepper output.

Preset values may be modified during run-time. A preset value of zero disables (resets) the totalizer compare function output causing the output to remain low.

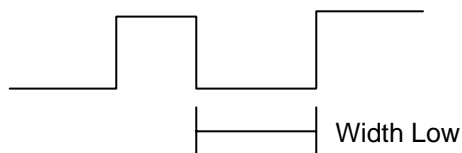
10.2.3 Pulse

In pulse mode, the high-speed input can measure the width or period of a pulse stream in one of four modes and provides a continuous indication of the last sampled value.

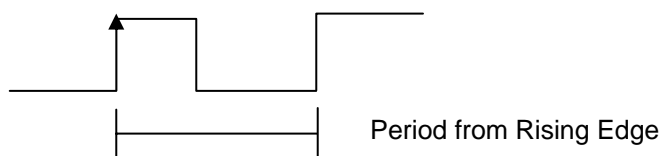
Width High 1 μ s Counts – In this sub-mode the accumulator value will contain the number of 1 μ s counts the pulse is high.



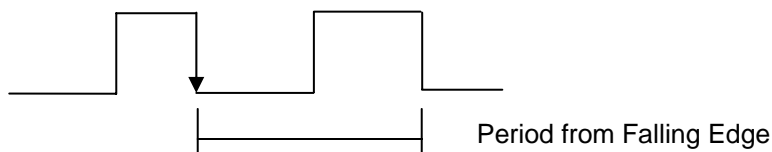
Width Low 1 μ s Counts - In this sub-mode the accumulator value will contain the number of 1 μ s counts the pulse is low.



Period Rising Edges 1 μ s Counts – In this sub-mode the period of the input signal is reported in one (1) μ s units. The period measurement will start on the rising edge of the input.



Period Falling Edges 1 μ s Counts – In this sub-mode the period of the input signal is reported in one (1) μ s units. The period measurement will start on the falling edge of the input.

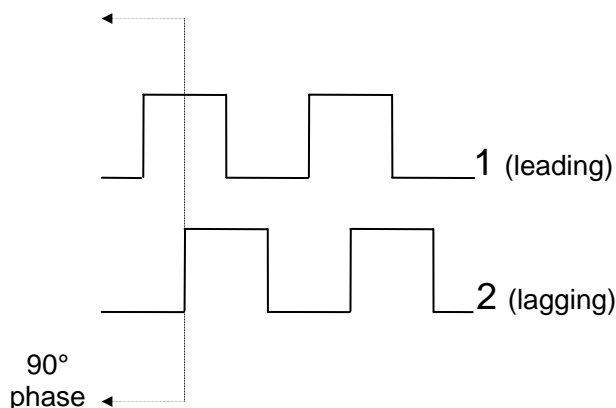


10.2.4 Quadrature

Two HSC inputs are consumed for each of the two possible Quadrature counters. For example, selecting quadrature mode for HSC 1 will use HSC inputs 1 and 2, which correspond to A and B quadrature signals. Therefore, HSC 1 and 3 may be configured for quadrature input. Alternately, HSC 3 may be configured to reset HSC1 (quadrature) count on a marker input

Quadrature mode works much like the totalizer except the accumulator will automatically increment or decrement based on the rotation phase of the two inputs. See the following example for more details. Quadrature inputs are typically used for reporting the value of an encoder.

Two modes are available for quadrature that select whether the accumulator counts up or down when the phase of input 1 leads input 2. Check your encoder's documentation to determine the output form it uses or try both modes to determine if the encoder counts up when expected.



Using the above waveforms and a HSC input configuration of “Quadrature” - “1 leads 2, count up,” the accumulator will count up when 1 is rising and 2 is low, 1 is high and 2 is rising, 1 is falling and 2 is high, and when 1 is low and 2 is falling. This results in 4 counts per revolution. So in order to determine the number of cycles, the accumulator would have to be divided by 4.

Three different options are available to reset (or set) the current count. They are:

- **Configured *Counts per Rev* value**
When configuring the quadrature function, a value may be specified under the *Counts per Rev* column. When rotation produces an increasing count, the quadrature accumulator resets to zero on reaching the *Counts per Rev* count. Alternately, when rotation produces a decreasing count, the quadrature accumulator is set to *Counts per Rev* – 1 on the count following zero. Specifying zero for this value allows the totalizer to count through the full 32-bit range before resetting.

For example if your encoder outputs 1024 counts per revolution, the value of 1024 can be entered into the configuration for *Counts per rev*. This will result in a counter that produces counts in the range of 0 to 1023.

- **Ladder control**
Setting registers %Q17 or Q19 resets quadrature (HSC) 1 or quadrature (HSC) 3 (respectively) with no additional configuration. Setting registers %Q18 or Q20 sets quadrature (HSC) 1 or quadrature (HSC) 3 (respectively) to *Counts per Rev* – 1.
- **Direct digital input control (HSC3) [Marker]**
When HSC input 1 and 2 are used for quadrature inputs, an additional choice of marker input becomes available for HSC input 3. The marker input is typically part of an encoder or motion system that signals when a cycle of motion is complete. When the marker input is triggered, the accumulator is reset to zero or to *Counts per rev* - 1 based on rotation direction.

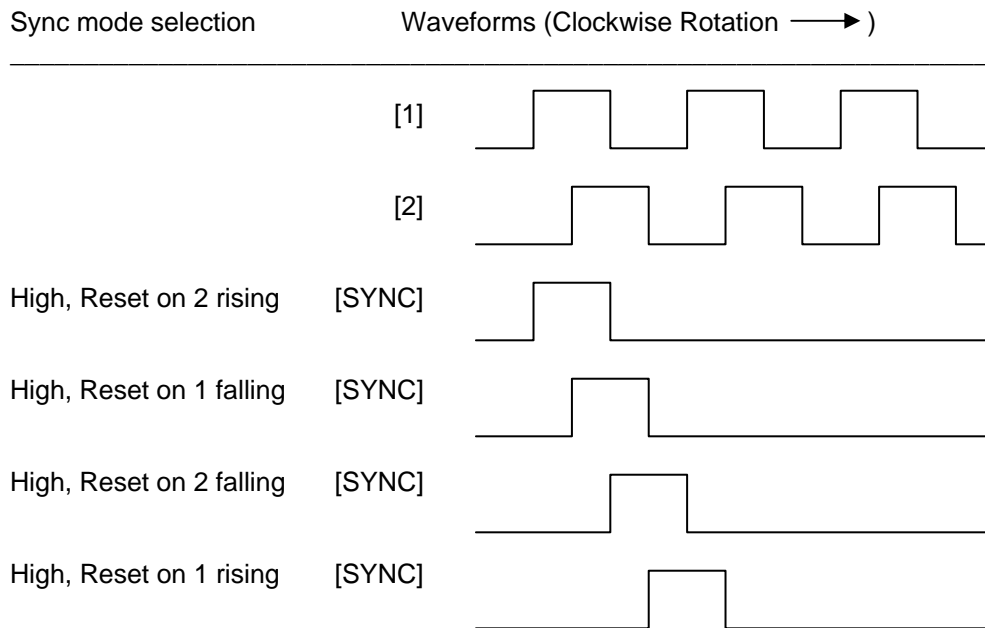
Marker reset operation is enabled when HSC3 is configured for *Marker* type. Once selected, one of several modes is available for marker operation. These modes can be sub-divided into two groups of marker operation.

Asynchronous modes ignore the quadrature inputs and reset the quadrature accumulator to zero on the configured edge (rising, falling or both). These are the most common settings used. When configuring, asynchronous mode selections are prefixed with the word *Async*.

Synchronous modes synchronize the reset (or set) to the selected quadrature input and the selected marker polarity. Figure 10.1 below indicates which mode to select based on the markers timing diagram. Consult the documentation provided with your encoder to determine the marker pulse timing.

Note that the Marker input is sampled within 50 micro seconds of the associated quadrature edge. It is left to the user to determine if this meets the time constraints of the measured drive.

Note that if the Marker input pulse consecutively spans more than one of the specified edges, quadrature-decoding operation is unpredictable.



*While not displayed in this figure, modes for low level (inverse logic) are also supported for each state.

Figure 10.1 – Sync pulse mode illustration

The accumulator is reset to zero on the specified edge if rotation is clockwise (as shown in figure 10.1 above). However, if rotation is reversed, the accumulator is alternately set to *Counts per rev* – 1 on that same physical edge. When direction is reversed, that same physical edge is seen (by the internal decoder) as having the opposite edge polarity as shown below.

Mode	Direction	A (HSC1)	B (HSC2)	Marker (HSC3)	Reset Value
Async, Reset on rising edge				Rising	0
Async, Reset on falling edge				Falling	0
Async, Reset on both edge				Both	0
High, Reset on 1 rising	Clockwise	Rising		High	0
“	Counter	Falling		High	CPR - 1
Low, Reset on 1 rising	Clockwise	Rising		Low	0
“	Counter	Falling		Low	CPR - 1
High, Reset on 1 falling	Clockwise	Rising		High	CPR - 1
“	Counter	Falling		High	0
Low, Reset on 1 falling	Clockwise	Rising		Low	CPR - 1
“	Counter	Falling		Low	0
High, Reset on 2 rising	Clockwise		Rising	High	0
“	Counter		Falling	High	CPR - 1
Low, Reset on 2 rising	Clockwise		Rising	Low	0
“	Counter		Falling	Low	CPR - 1
High, Reset on 2 falling	Clockwise		Rising	High	CPR - 1
“	Counter		Falling	High	0
Low, Reset on 2 falling	Clockwise		Rising	Low	CPR - 1
“	Counter		Falling	Low	0

10.3 HSC Functions Register Map

Register	Frequency	Totalize	Pulse	Quad
%AI5-6	HSC1 (function) Accumulator			Quad 1 Acc
%AI7-8	HSC2 (function) Accumulator			
%AI9-10	HSC3 (function) Accumulator			Quad 2 Acc
%AI11-12	HSC4 (function) Accumulator			
%AQ1-2		HSC1 Preset		
%AQ3-4		HSC2 Preset		
%Q17		Clear HSC1		Clear Quad 1
%Q18		Clear HSC2		Set Quad 1
%Q19		Clear HSC3		Clear Quad 2
%Q20		Clear HSC4		Set Quad 2

10.4 Pulse Width Modulation (PWM) Functions

On units that support the PWM, two dedicated outputs are available that can be configured for one of four modes of operation. Those modes are Normal, PWM, HSC (count = PV) and Stepper.

10.4.1 Normal

When either Q1 or Q2 is configured for Normal operation, the digital output registers %Q1 and %Q2 drives that respective output.

10.4.2 PWM

When either Q1 or Q2 is configured for PWM, the PWM function drives that respective output. Both PWM channels may be individually enabled; however, when both PWM outputs are enabled, both share the same output frequency (with the low going pulses synchronized). Otherwise, each PWM's pulse width can be independently adjusted.

The PWMs require three parameters (%AQs) to be set for operation. These parameters may be set at run-time.

- **Prescale Count**
The prescale (%AQ5-6) count sets the resolution of the internal counter used for generating the PWM output. The (prescale count + 1) is a divisor applied to a 16MHz clock that drives the internal PWM counter. For the highest resolution PWM output, this value should be set as low as possible (0 provides a 1/16 micro second resolution). Both the Period and Duty cycle (pulse width) are based on *counts* of the internal PWM counter.

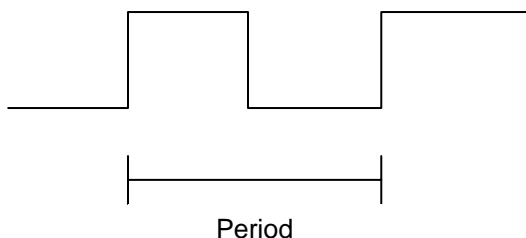
The frequency of the PWM output is calculated using the following formula:

$$\text{Frequency} = \frac{16,000,000}{(\text{Pr escaleCount}+1) \times \text{PeriodCount}}$$

- Period Count

This value (%AQ7-8) sets the period of the output signal by specifying the number of internal PWM counter *counts* before the cycle is reset (larger count results in a smaller frequency). The duration of each *count* is determined by the prescaler value. This parameter affects the Period of both PWM outputs.

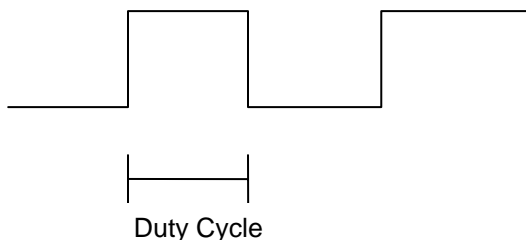
See the previous formula to see how the prescale and period counts create an output frequency. For example, setting the PWM for 1 μ s resolution (prescale=15), and a period count of 20,000 would result in a 50 Hz output.



- Duty Cycle Count

This value (PWM1: %AQ1-2, PWM2: %AQ3-4) sets the width of the output signal by specifying the number of internal PWM counter *counts* that the output is maintained high. The duration of each *count* is determined by the prescaler value. Each PWM channel has its own duty cycle count parameter.

Setting the period count to 1000 and the duty cycle count to 500 results in a duty cycle of 50 percent. Changing just the duty cycle count to a value of 250 results in a duty cycle of 25 percent.



At controller power-up or during a download, the PWM output is maintained at zero until both the Period (count) and the Duty cycle (count) are loaded with non-zero values. When the controller is placed in stop mode, the state of the PWM outputs is dependent on the *PWM State on Controller Stop* configuration. This configuration allows for either hold-last-state or specific prescale, period and duty cycle counts. Specifying zero for either the period or duty causes the PWM output to remain low during stop mode.

Note that the nominal output driver turn-on-time delay (to reach 50% output) is 25 microseconds. Therefore, this limitation should be considered when determining both the minimum pulse width and the duty cycle accuracy of the application.

10.4.3 HSC (High Speed Counter)

When either Q1 or Q2 is configured for HSC operation, HSC1 or HSC2 totalize functions are extended to allow respective direct output control based on a comparison of the current count and a preset value (PV). See totalize in the HSC section above for more information.

10.4.4 Stepper Function

When Q1 is configured for Stepper, the stepper function is enabled at the Q1 output. Only one stepper function and output is available.

Note that when Q1 is configured for stepper operation, Q2 operation is limited to direct digital output.

The Stepper requires five parameters (%AQs) to be set for operation. These parameters may be set at run-time but are 'latched' when the stepper is commanded to start.

Start Frequency (cycles per second)

This value (%AQ1) sets the frequency for the first cycle during the acceleration phase and the frequency of the last cycle during the deceleration phase. When an acceleration or deceleration count is specified, the Start Frequency must be greater than 0 and must not exceed the run frequency or an error is generated.

Run Frequency (cycles per second)

This value (%AQ2) sets the frequency for the last cycle during the acceleration phase, the consistent frequency during the run phase, and the frequency of the first cycle during the deceleration mode. The Run Frequency must be greater than 0 and must not exceed 5000 cycles/sec. or an error is generated.

Acceleration Count

This value (%AQ3-4) sets the number of cycles to occur within the acceleration phase. The frequency of the cycles within this mode will vary linearly between the specified Start and Run frequency. The Accel count must not equal 1 or an error is generated. Setting this value to zero disables this phase.

Run Count

This value (%AQ5-6) sets the number of cycles to occur within the run phase. The frequency of the cycles within this mode is constant at the specified Run frequency. The Run count may be any value. Setting this value to zero disables this phase.

Deceleration Count

This value (%AQ7-8) sets the number of cycles to occur within the deceleration phase. The frequency of the cycles within this phase will vary linearly between the specified Run and Stop frequency. The Decel count must not equal 1 or an error is generated. Setting this value to zero disables this phase.

The stepper provides two Boolean registers to provide stepper status

Ready/Done

A high indication on this register (%I30) indicates the stepper sequence can be started (i.e. not currently busy).

Error

A high indication on this register (%I31) indicates that one of the analog parameters specified above is invalid or the stepper action was aborted before the operation was complete. This register is cleared on the next start command if the error was corrected.

The stepper requires one discrete register (%Q1) to control the stepper action. Setting this register starts the stepper cycle. This register must remain set to complete the entire cycle. Clearing this register before the cycle is complete aborts the step sequence and sets the error bit.

Note that setting the PLC mode to Stop while the stepper is in operation causes the stepper output to immediately drop to zero and the current stepper count to be lost.

Note that stepper output level may cause damage or be incompatible with some motor driver inputs. Consult drive documentation to determine if output level and type is compatible.

10.5 PWM functions register map

Register	PWM	HSC	Stepper
%AQ1	PWM1 Duty Cycle (32-bit)	HSC1 Preset Value	Start Frequency
%AQ2			Run Frequency
%AQ3	PWM2 Duty Cycle (32-bit)	HSC2 Preset Value	Accel Count (32-bit)
%AQ4			Run Count (32-bit)
%AQ5	PWM Prescale (32-bit)		Decel Count (32-bit)
%AQ6			
%AQ7	PWM Period (32-bit)		Run
%AQ8			Ready/Done
%Q1			Error
%I30			
%I31			

10.6 PWM Examples

All of the PWM examples use the following formula.

$$\text{Frequency} = \frac{16,000,000}{(\text{Prescale}+1) \times \text{PeriodCount}}$$

Example 1

To get a 50% Duty Cycle @ 10 kHz waveform on PWM1:

Set %AQ1-2 = 50 (duty cycle count)
 Set %AQ5-6 = 15 (prescale count)
 Set %AQ7-8 = 100 (period count)

Example 2

To get a 50% Duty Cycle on PW1 and 90 % Duty Cycle on PWM2 @ 1 kHz waveform:

Set %AQ1-2 = 500 (duty cycle count)
 Set %AQ3-4 = 900 (duty cycle count)
 Set %AQ5-6 = 15 (prescale count)
 Set %AQ7-8 = 1000 (period count)

Example 3

To turn PWM 1 output ON all the time

Set %AQ1-2 = Same value as AQ7-8 (duty cycle count)
 Set %AQ5-6 = Any value (prescale count)
 Set %AQ7-8 = Non-Zero value (period count)

Example 4

To turn PWM 1 output OFF all the time

Set %AQ1-2 = 0 (duty cycle count)
 Set %AQ5-6 = Any value (prescale count)
 Set %AQ7-8 = Any value <or> 0 (period count)

10.7 STP Examples

Example 1

10,000,000 steps control sequence

The following example starts at 2.5 kHz and ramps up to 5 kHz during the first 1,000,000 steps.

Then, it runs at 5 kHz for the next 8,000,000 steps. Finally during the last 1,000,000 steps it slows to a stop.

```

Set %AQ1 = 2500 (Hz)           {Start Frequency}
Set %AQ2 = 5000 (Hz)           {Run Frequency}
Set %AQ3-4 = 1000000 (Steps) {Accel Count}
Set %AQ5-6 = 8000000 (Steps) {Run Count}
Set %AQ7-8 = 1000000 (Steps) {Decel Count}

```

Example 2

5,000,000 steps control sequence

The following example starts at 0.5 kHz and ramps up to 1 kHz during the first 2,000,000 steps.

Then, it runs at 1 kHz for the next 2,000,000 steps. Finally during the last 1,000,000 steps it slows to a stop.

```

Set %AQ1 = 500 (Hz)           {Start Frequency}
Set %AQ2 = 1000 (Hz)          {Run Frequency}
Set %AQ3-4 = 2000000 (Steps) {Accel Count}
Set %AQ5-6 = 2000000 (Steps) {Run Count}
Set %AQ7-8 = 1000000 (Steps) {Decel Count}

```

Example 3

6,000,000 steps control sequence

The following example starts at 50 Hz and ramps up to 250 Hz during the first 150,000 steps. Then, it runs at 250 Hz for the next 5,500,000 steps. Finally during the last 350,000 steps it slows to a stop.

```

Set %AQ1 = 50 (Hz)           {Start Frequency}
Set %AQ2 = 250 (Hz)          {Run Frequency}
Set %AQ3-4 = 150000 (Steps) {Accel Count}
Set %AQ5-6 = 5500000 (Steps) {Run Count}
Set %AQ7-8 = 350000 (Steps) {Decel Count}

```

Note: The highest usable frequency is 65 KHz for the PWM output.

CHAPTER 11: SYSTEM SETTINGS AND ADJUSTMENTS

11.1 System Menu - Overview

The XLe/XLt controller has a built-in System Menu, which lets the user view System Settings and make adjustments. To start the System Menu, press the ↓ and ↑ keys at the same time (or set %SR3 to 1), which will display the Main Menu, as shown in **Figure 11.1** and in **Figure 11.1**. Then use the ↓ and ↑ keys to select a **Main Menu** item and press **Enter** to display the item's Sub-Menu.

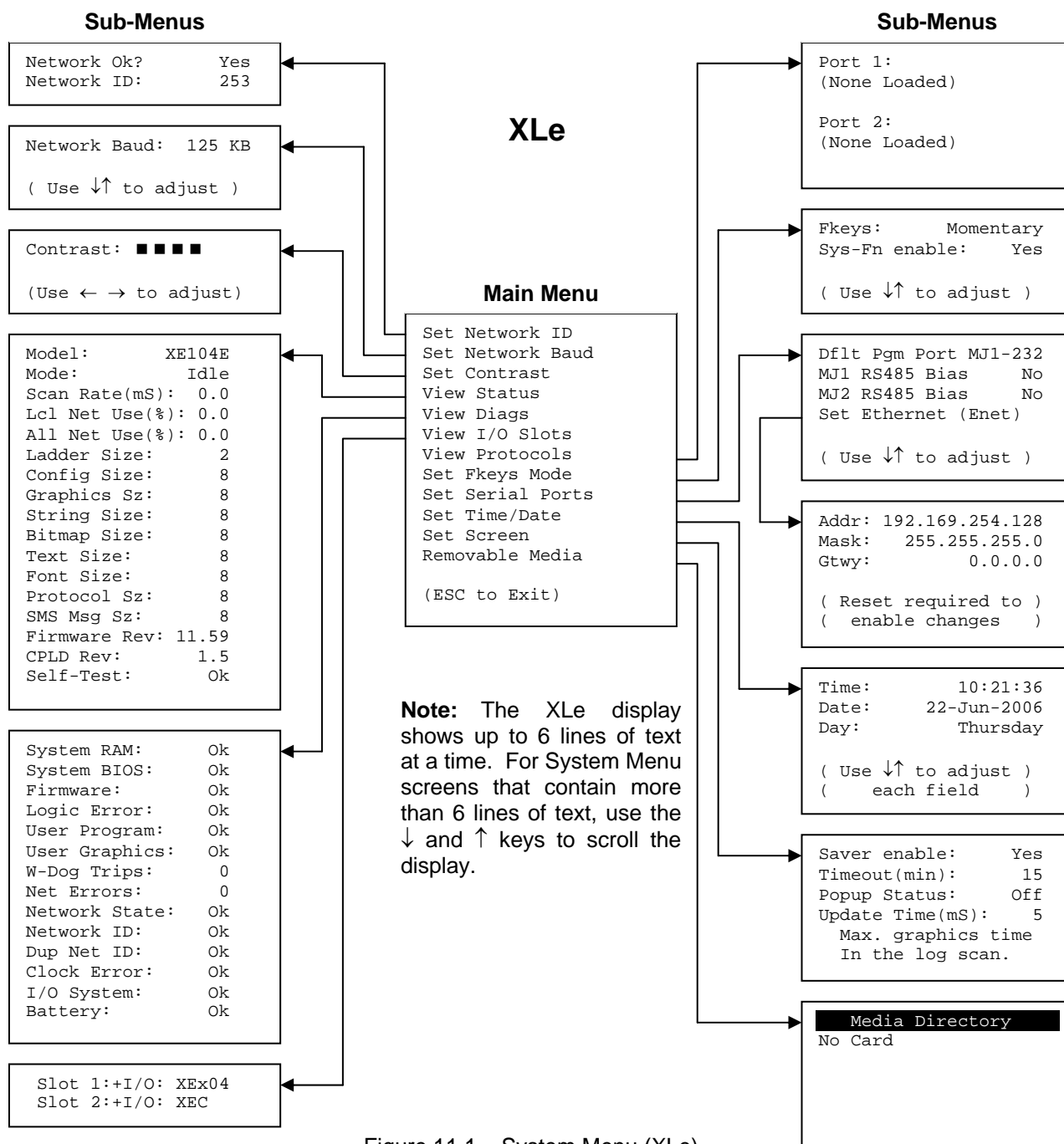


Figure 11.1 – System Menu (XLe)

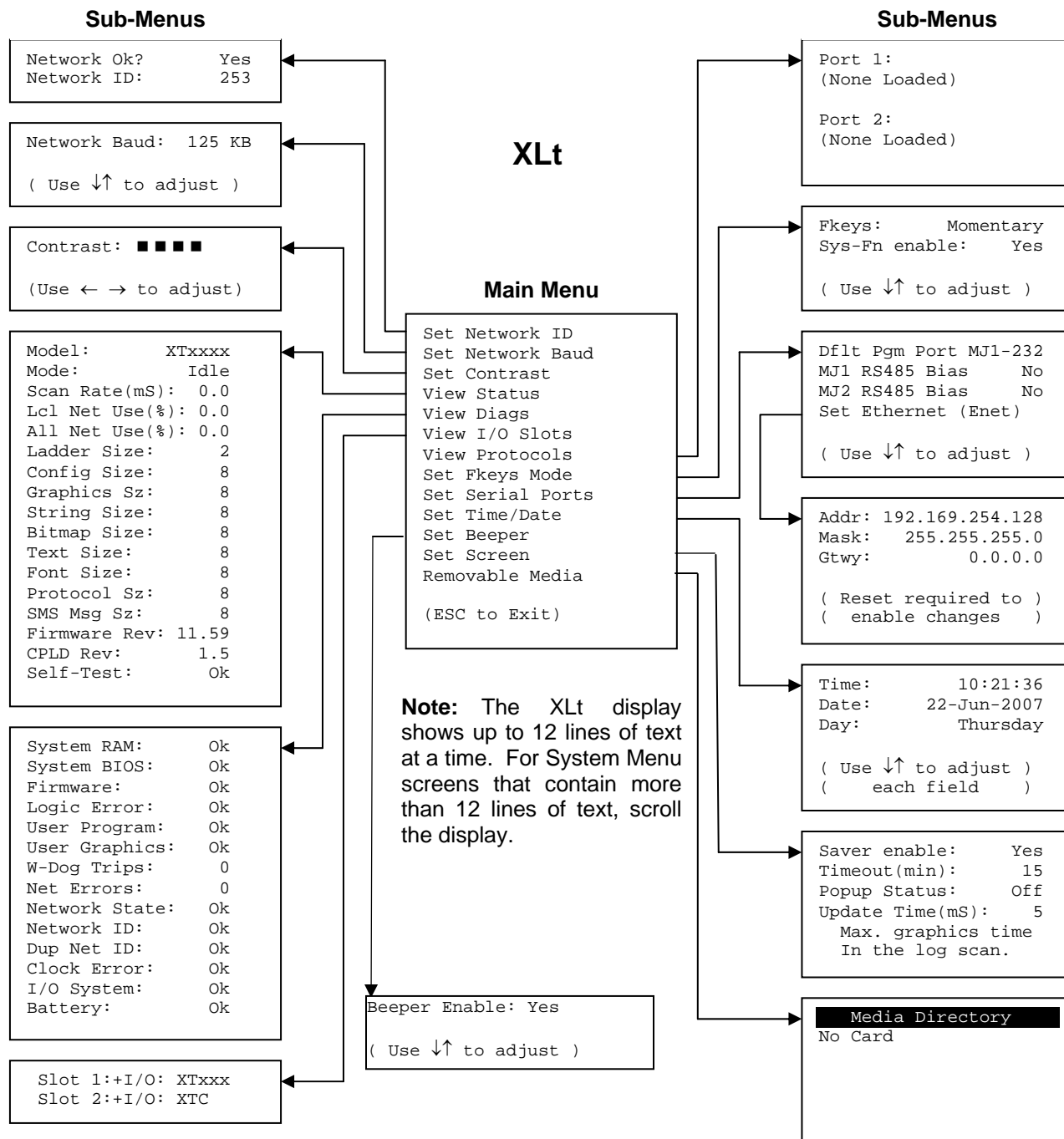


Figure 11.2 – System Menu (XLt)

11.2 System Menu – Navigation and Editing

As mentioned above, the System Menu is started by pressing the ↓ and ↑ keys at the same time for the XLe, or the System key on the XLt. Then, either press ESC to exit the System Menu, or use the ↓ and ↑ keys to select an item and press **Enter** to display the item's Sub-Menu.

A Sub-Menu generally shows a list of System Settings and their values. After opening a Sub-Menu, if any of its System Settings are editable, the first System Setting that can be edited is highlighted. If desired, the ↓ and ↑ keys can be used to select a different System Setting to be edited.

At this point, either press **ESC** to exit the Sub-Menu (returning to the Main Menu) or press **Enter** to edit the highlighted System Setting. If **Enter** is pressed, the System Setting's value will be highlighted, indicating that it is ready to be modified.

When modifying a System Setting's value, use either the arrow keys (← → ↓ ↑) or the numeric keys, or the appropriate touch screen icons to select a new value.

The arrow keys are used to edit System Settings that have just a few possible values. Each time the arrow key is pressed, a new possible value is displayed. When the desired value appears, press the **Enter** key to save it; otherwise press the **ESC** key to cancel the edit.

The numeric keys are normally used to enter numeric System Settings. In addition, to edit a single numeric digit, use the ← or → key to select the digit and then either press a numeric key or use ↓ or ↑ to modify the digit. In any case, after entering the new desired value, press the **Enter** key to save it; otherwise press the **ESC** key to cancel the edit.

11.3 System Menu – Details

The following sections describe each of the Sub-Menus in detail.

Set Network ID

The Network ID Sub-Menu only appears for XLe/XLt models that have CAN ports (XE1xx). This Sub-Menu displays two System Settings of which only **Network ID** is editable.

Network Ok?	Yes	= NET1 connected to a CAN network and functioning properly
	No	= Not ready to communicate on CAN network
Network ID:	1 to 253	= This node's CsCAN Network ID; must be unique on network

Set Network Baud

The Network Baud Sub-Menu only appears for XLe/XLt models that have CAN ports (XE1xx). This Sub-Menu displays just one System Setting and it is editable.

Network Baud?	125 KB	= 125 KBaud CAN network
	250 KB	= 250 KBaud CAN network
	500 KB	= 500 KBaud CAN network
	1 MB	= 1 MBaud CAN network

Set Contrast

The Set Contrast Sub-Menu displays just one System Setting and it is editable.

Contrast: ■ ■ ■ ■ = Current display contrast setting

View Status

The View Status Sub-Menu displays up to 17 System Settings. The **Lcl Net Use %** and **All Net Use %** System Settings only appear for XLe/XLt models that have CAN ports (XE1xx). Only the **Mode** System Setting is editable.

Model:	XExyyz	= 5 or 6 character Model number of this XLe/XLt unit x is 1 for models that have a CAN port; 0 = no CAN port yy indicates the installed I/O module; 00 = no I/O module z indicates the installed COM module; N = no COM module
Mode:	Idle Dolo Run	= XLe/XLt is in Idle mode = XLe/XLt is in Do I/O mode = XLe/XLt is in Run mode
Scan Rate(mS):	0.0 0.1 to 999.9	= XLe/XLt is not in Run mode = Average number of mS for each ladder scan
Lcl Net Use %:	0.0 to 100.0	= CAN network bandwidth % used by this XLe/XLt node
All Net Use %:	0.0 to 100.0	= CAN network bandwidth % used by all nodes
Ladder Size:	x	= Number of bytes in application ladder program
Config Size:	x	= Number of bytes in application I/O configuration
Graphics Sz:	x	= Number of bytes in application graphic screens
String Size:	x	= Number of bytes in application string table
Bitmap Size:	x	= Number of bytes in application bitmaps
Text Size:	x	= Number of bytes in application text tables
Font Size:	x	= Number of bytes in application font tables
Protocol Sz:	x	= Number of bytes in application downloaded protocols
SMS Msg Sz:	x	= Number of bytes in application SMS protocol configuration
Firmware Rev:	xx.yy	= Current firmware version
CPLD Rev:	x.y	= Current CPLD (Complex Programmable Logic Device) version
Self-Test:	Ok Fault	= All power-on self-tests passed = One or more power-on self-tests failed

View Diags

The View Diags Sub-Menu displays up to 14 System Diagnostics, all of which are not editable. The **Net Errors**, **Network State**, **Network ID** and **Dup Net ID** System Diagnostics only appear for XLe/XLt models that have CAN ports (XE1xx).

The first five System Diagnostics are critical. If any of them indicate a Fault condition, the XLe/XLt will not enter or remain in Run mode, and the problem must be investigated and corrected.

System Ram:	Ok	= System RAM power-up self-test passed
	Fault	= System RAM power-up self-test failed
System BIOS:	Ok	= System BIOS power-up self-test passed
	Fault	= System BIOS power-up self-test failed
Firmware:	Ok	= Firmware power-up self-test passed
	Fault	= Firmware power-up self-test failed
Logic Error:	Ok	= All executed ladder instructions are legal for loaded firmware
	Fault	= A ladder instruction <u>not</u> supported by firmware was found
User Program:	Ok	= Ladder program and I/O configuration loaded successfully
	Fault	= Ladder program or I/O configuration not loaded or load failed

The last nine System Diagnostics are informational. If any of them indicate a Warning condition, the XLe/XLt can still enter and remain in Run mode, but the problem should be investigated and corrected.

User Graphics:	Ok	= Application graphics objects loaded successfully
	Fault	= Application graphics objects not loaded or load failed
W-Dog Trips:	0	= Watchdog timer has not tripped since the last power-up
	x	= Number of times watchdog timer has tripped
Net Errors:	0	= No CAN network bus-off errors have occurred
	x	= Number of CAN network bus-off errors that have occurred
Network State:	Ok	= At least one other node was found on the CAN network
	Warning	= No other nodes were found on the CAN network
Network ID:	Ok	= This node's CAN Network ID is in the range 1 to 253
	Warning	= This node's CAN Network ID was out of range at power-up
Dup Net ID:	Ok	= This node's Network ID is unique on the CAN network
	Warning	= This node's Network ID is duplicated in another node
Clock Error:	Ok	= Time and date have been set
	Warning	= Time and date need to be set
I/O System:	Ok	= I/O configuration matches the installed I/O and COM modules
	Warning	= I/O configuration needs updating to match installed modules
Battery:	Ok	= Backup battery operating properly
	Warning	= Backup battery needs to be replaced

View I/O Slots

The View I/O Slots Sub-Menu displays two System Settings, both of which are not editable.

Internal to the XLe/XLt, there is a CPU board, and up to two installed modules. Models XE000 and XE100 have no installed I/O or COM modules. All other models have an I/O module in Slot 1 and can have a user-installed COM module in Slot 2.

Depending on which I/O module is installed and which I/O module has been configured by Cscape, one of the following six System Settings should appear for Slot 1:

Slot 1: I/O: Empty	= No I/O module installed or configured
Slot 1: *Unsupported	= Unsupported I/O module installed
Slot 1: -I/O Missing	= No I/O module installed but an I/O module is configured
Slot 1: +I/O: XExyy	= yy I/O module installed but no I/O module configured
Slot 1: ?I/O: XExyy	= yy I/O module installed but another I/O module configured
Slot 1: I/O: XExyy	= yy I/O module installed and configured properly

Depending on the COM module that is installed and the COM module that has been configured by Cscape, one of the following six System Settings appears for Slot 2:

Slot 2: I/O: Empty	= No COM module installed or configured
Slot 2: *Unsupported	= Unsupported COM module installed
Slot 2: -I/O Missing	= No COM module installed but a COM module is configured
Slot 2: +I/O: XzC	= z COM module installed but no COM module configured
Slot 2: ?I/O: XzC	= z COM module installed but another COM module configured
Slot 2: I/O: XzC	= z COM module installed and configured properly

View Protocols

The View Protocols Sub-Menu displays two System Settings, both of which are not editable.

As mentioned in CHAPTER 5, both the MJ1 (Port 1) and MJ2 (Port 2) serial ports support downloadable protocols. To assign a downloadable protocol to an XLe/XLt serial port, select the **Protocol Config** item in Cscape's Program menu and then setup a protocol for Port 1 or Port 2 (or both).

In the View Protocols Sub-Menu, the currently downloaded protocol, if any, and its version number are displayed for both Port 1 and Port 2.

Port 1:	
Protocol name	= (None Loaded) or name of the protocol assigned to MJ1
Protocol version	= Blank or version of the protocol assigned to MJ1
Port 2:	
Protocol name	= (None Loaded) or name of the protocol assigned to MJ2
Protocol version	= Blank or version of the protocol assigned to MJ2

Set Fkeys

The Set Fkeys Sub-Menu displays two System Settings, both of which are editable.

Fkeys:	Momentary	= %K1-10 bits go On & Off as F1-F10 are pressed & released
	Toggle	= %K1-10 bits toggle each time F1-F10 are pressed
SYS_Fn enable:	Yes	= Reset and all clear system functions enabled
	No	= Reset and all clear system functions disabled

Set Serial Ports

The Set Serial Ports Sub-Menu displays three System Settings, all of which are editable, and one optional item. For the **Dflt Pgm Port** System Setting, only MJ1-232 can be selected, unless either an Ethernet (XEC) or a Modem (XMC) COM module is installed. Also, the **Set Ethernet (Enet)** item only appears if an Ethernet COM module is installed.

Dflt Pgm Port:	MJ1-232	= MJ1 RS232 port is the default programming port
	Enet	= Ethernet COM module is the default programming port
	Modem	= Modem COM module is the default programming port
MJ1 RS485 Bias:	No	= MJ1 RS485 bias resistors are <u>not</u> switched in
	Yes	= MJ1 RS485 bias resistors are switched in
MJ2 RS485 Bias:	No	= MJ2 RS485 bias resistors are <u>not</u> switched in
	Yes	= MJ2 RS485 bias resistors are switched in
Set Ethernet (Enet)		= Select and press Enter to setup the Ethernet COM module

Set Ethernet (Enet)

The Set Ethernet (Enet) Sub-Menu displays three System Settings, all of which are editable. The values shown below are the default values. Note that if **Gtwy** is set to 0.0.0.0, Ethernet communication will be confined to the local network.

Addr:	192.168.254.128	= IP Address for installed Ethernet COM module
Mask:	255.255.255.0	= Net Mask for installed Ethernet COM module
Gtwy:	0.0.0.0	= Gateway device IP Address for installed Ethernet COM module

Set Time/Date

The Set Time/Date Sub-Menu displays three System Settings. **Time** and **Date** are editable, and **Day** is automatically calculated from the **Date** setting. Note that **Time** and **Date** are split into three editable fields each. Use ← or → to select a field and then use ↓ or ↑ to edit the field.

Time:	10:21:36	= Current time (hours:minutes:seconds in 24-hour format)
Date:	22-Jun-2006	= Current date (day-month-year)
Day:	Thursday	= Current day of week calculated from the Date setting

Note: After changing the Ethernet Addr, Mask, or Gtwy, the XLe/XLt must be power-cycled (or reset) before the changes take effect.

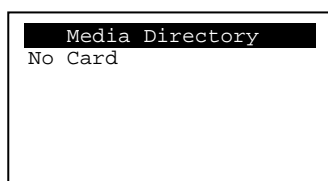
XLt Specific:Set Beeper (XLt only)

The Set Beeper Sub-Menu displays one System Setting, which is editable

Beeper enable: Yes (*default*)= Enables beeper **No** = Disables beeper (does NOT affect ladder access)

Removable Media**XLe Specific:**

The Removable Media Sub-Menu displays the Removable Media Manager (see CHAPTER 8). After selecting Removable Media from the Main Menu, one of four Sub-Menu screens will appear:



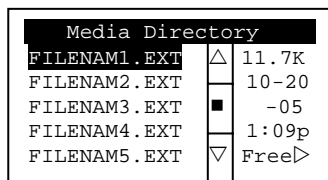
= No Micro SD card has been installed in the Memory slot



= Micro SD card is installed, but it is still initializing



= Micro SD card is installed and initialized, but contains no files



= Micro SD card is installed and initialized, and it contains files

Shows size of highlighted file or shows <DIR> if directory is highlighted

Shows the date file or directory was created or last modified

Shows the time file or directory was created or last modified

Scrollbar only appears if displayed directory contains more than five files and/or directories.

Shows up to five files or directory names at a time

If the Removable Media Manager displays files or directories, as in the last example above, there are several options available:

If → is pressed, the number of total and free bytes is displayed. Then, pressing ← returns to the normal file and directory display.

If a soft key (on either side of the display) is pressed, a pop-up window appears on the right side of the display, showing the function key options as follows:

F1 Delete	= Delete the highlighted file or directory
F2 DelAll	= Delete all files and directories
F3 Format	= Format the Micro SD card
F4 SavPgm	= Save XLe/XLt application to DEFAULT.PGM
Esc Cancel	= Cancel current operation (back up one screen)

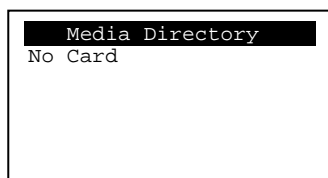
Pressing the soft key again or pressing ESC returns to the normal file and directory display.

If a directory name is highlighted, pressing **Enter** will switch to that directory showing its files and sub-directories. In a sub-directory, highlighting .. (dot dot) and pressing **Enter** will move up one directory

Removable Media

XLt Specific:

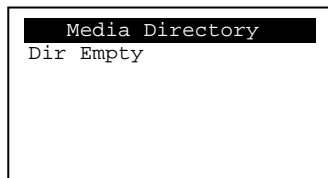
The Removable Media Sub-Menu displays the Removable Media Manager (see CHAPTER 8). After selecting Removable Media from the Main Menu, one of four Sub-Menu screens will appear:



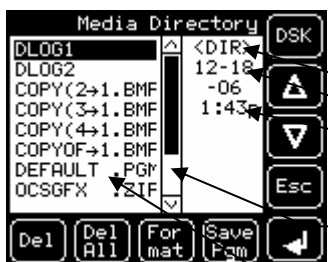
= No Micro SD card has been installed in the Memory slot



= Micro SD card is installed, but it is still initializing



= Micro SD card is installed and initialized, but contains no files



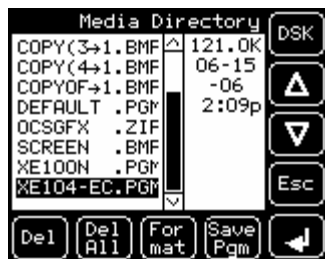
= Micro SD card is installed and initialized, and it contains files

Shows size of highlighted file or shows <DIR> if directory is highlighted
Shows date the file or directory was created or last modified
Shows time the file or directory was created or last modified

Scrollbar only appears if displayed directory contains more than five files and/or directories.

Shows up to five file or directory names at a time

If the Removable Media Manager displays files or directories there are several options available:



Delete
DelAll
Format
SavPgm



DSK



Esc

- = Delete the highlighted file or directory
- = Delete all files and directories
- = Format the Micro SD card
- = Save XLT application to DEFAULT.PGM
- = Enter Key
- = Shows number of total and free bytes in removable memory
- = Up Arrow
- = Down Arrow
- = Cancel current operation (back up one screen)

Pressing **Esc** returns to the normal file and directory display.

If a directory name is highlighted, pressing **Enter** will switch to that directory showing its files and sub-directories. In a sub-directory, highlighting .. (dot dot) and pressing **Enter** will move up one directory

CHAPTER 12: USER INTERFACE

12.1 Screen Navigation

The screen navigation on the XLe/XLt is quite flexible. Basic methods will be described here. Control programming can be used to create complex screen navigation techniques.

One form of screen navigation is the **Jump Screen** graphics object. This object is typically tied to a soft key (One of the four keys to the sides of the display for the XLe and at the bottom of the screen for the XLt). Pressing the soft key will switch to the screen that is programmed.



Figure 12.1 – Typical Screen Jump Object (XLe)

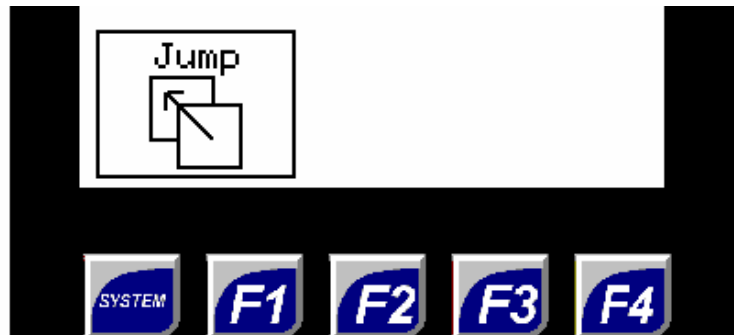


Figure 12.2 – Typical Screen Jump Object (XLt)

Screen jumps can also be triggered on other keys or based on control logic for more advanced applications. To allow the operator to change screens, a **screen jump object** is generally used. This object may be visually **represented as a button** (responding to touch) or remain invisible and logically tied to an OCS register. An optional system ICON may be configured for display along with the legend, which aids in identifying the object as one that causes a screen change.

12.2 Ladder Based Screen Navigation

Ladder logic can use several techniques to control screen navigation. Coils can be tied to %D registers to make them screen coils. These coils have two modes, switch and alarm. If the ladder program energizes an alarm display coil, the screen associated with this coil is displayed and overrides the normal user screens. This is designed to show alarm conditions or to display other ladder-detected events. When the text coil is de-energized, the previous screen that was being viewed before the alarm is returned.

The switch display coil switches to the associated screen when it is energized. Once it is de-energized the screen remains until it is switched by the user or ladder.

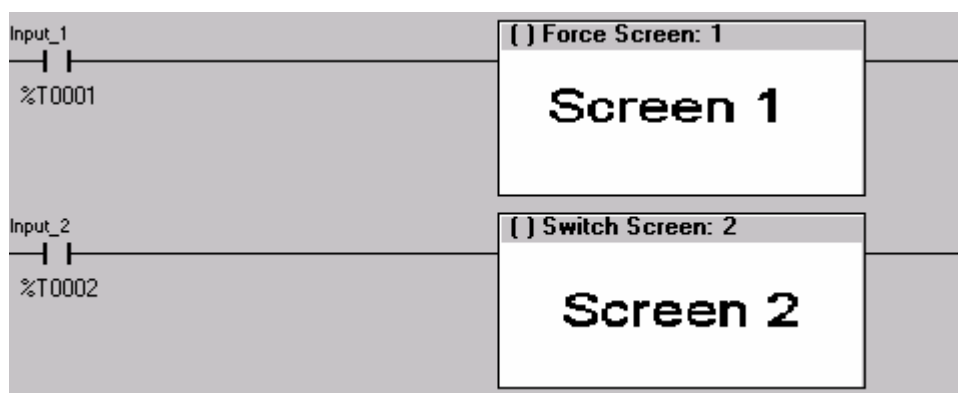


Figure 12.3 – Force and Switch Coils in Ladder Programming

There is also a system register that can be used to for control based screen navigation. %SR1 can be read to determine the current screen or written to change the current screen.

Refer to the on-line help in Cscope for more information on control-based screen navigation.

12.3 Using Editable Screen Objects

When a screen contains editable objects, one of the objects will be selected by default. Selected objects will be outlined with a dotted line. The arrow keys can be used to navigate the editable objects and allow selection of an object to edit. When the object to be edited is selected press the **Enter** button. This enters the objects editing mode.

The most common editable object is the numeric object.

XLe Specific:

When in edit mode, a cursor appears on one digit of the editable field. Use the direction keys \leftarrow and \rightarrow to move the cursor to the desired position. Use the \uparrow and \downarrow keys to increment or decrement the digit or enter the number/data with the alphanumeric keys.

XLt Specific:

The most common editable object is the numeric object. To edit, touch the object and pop-up keypad will appear to allow editing the value.

The value chosen by the operator can not exceed the minimum or maximum set by the user program. If the user tries to exceed the maximum point or enter a value below the minimum point, the value does not change.

Note: If the XLe/XLt displays >>>>> in a numeric field, the value is too big to display in the field or is above the maximum for an editable field. If the XLe/XLt displays <<<<< in a numeric field, the value is too small to display or is below the minimum for an editable field.

For addition information on a specific object please see the on-line help in Cscape.

XLt Specific:**Beeper Acknowledgement**

The XLt contains an internal beeper that provides an audible acknowledgment when an operator touches a graphic object that accepts touch input. When the graphical object is enabled, a short 5mSec tone is emitted. When the graphical object is disabled, a longer 100mSec tone is emitted to enounce that graphical object is not currently accepting the touch input.

If beep acknowledgement is not desired, the beeper function can be disabled from the system menu.

NOTES

CHAPTER 13: REGISTERS

13.1 Register Definitions

When programming the XLe/XLt, data is stored in memory that is segmented into different types. This memory in the controller is referred to as registers. Different groups of registers are defined as either bits or words (16 bits). Multiple registers can usually be used to handle larger storage requirements. For example 16 single bit registers can be used to store a Word or two 16 bit registers can be used to store a 32-bit value.

Below is a list of the type of registers found in the XLe/XLt.

%AI Analog Input

16-bit input registers used to gather analog input data such as voltages, temperatures, and speed settings coming from an attached device.

%AQ Analog Output

16-bit output registers used to send analog information such as voltages, levels or speed settings to an attached device.

%AIG Global Analog Input

Specially defined 16-bit input registers that come from the network.

%AQG Global Analog Output

Specially defined 16-bit output registers that go to the network.

%D Display Bit

These are digital flags used to control the displaying of screens on a unit which has the ability to display a screen. If the bit is SET, the screen is displayed.

%I Digital Input

Single-bit input registers. Typically, an external switch is connected to the registers.

%IG Global Digital Input

Specially defined single-bit inputs that come from the network.

%K Key Bit

Single-bit flags used to give the programmer direct access to any front panel keys appearing on a unit.

%M Retentive Bit

Retentive single-bit registers.

%Q Digital Output

Single-bit output registers. Typically, these bits are connected to an actuator, indicator light or other physical outputs.

%QG Global Digital Output

Specially defined single-bit outputs that go to the network.

%R General Purpose Register

Retentive 16-bit registers.

%S System Bit

Single-bit bit coils predefined for system use.

%SR System Register

16-bit registers predefined for system use.

%T Temporary Bit

Non-retentive single-bit registers.

13.2 Useful %S and %SR registers**Table 13.1 – Common %S Register Definitions**

Register	Description
%S1	Indicate First Scan
%S2	Network is OK
%S3	10mS timebase
%S4	100mS timebase
%S5	1 second timebase
%S6	I/O is OK
%S7	Always ON
%S8	Always OFF
%S9	Pause 'n Load soon
%S10	Pause 'n load done
%S11	I/O being forced
%S12	Forcing is enabled
%S13	Network I/O is OK
%S16	Ethernet COM module is OK

Table 13.2 – Common %SR Register Definitions

Register	Description
%SR1	This register displays/controls the current user scrollable screen. Setting this register to 0 displays no user screens
%SR2	This register displays/controls the current alarm screen.
%SR6	This register displays the average scan rate of the controller in tenths of milliseconds. (123 = 12.3 mSec)
%SR44	<i>This register displays the seconds from the real time clock</i>
%SR45	This register displays the minutes from the real time clock.
%SR46	This register displays the hours from the real time clock.
%SR47	This register displays the day of the month from the real time clock.
%SR48	This register displays the month from the real time clock. 1 = January ... 12 = December.
%SR49	This register displays the four digit year from the real time clock.
%SR50	This register displays the day of the week from the real time clock. 1 = Sunday, 2 = Monday ... 7 = Saturday
%SR56	This register displays the current key being pressed on the controller keypad.
%SR57	This register displays/controls the LCD backlight. 0 = OFF, non-zero = ON
%SR175	Status of the removable media
%SR176 to %SR177	This register shows the amount of free space on the inserted removable media in bytes. This is a 32-bit value.
%SR178 to %SR179	This register shows the total size of the inserted removable media in bytes. This is a 32-bit value.

Table 13.2 – Common %SR Register Definitions	
%SR181	This register is a bit-mapped indicator of the advanced alarm manager. Each bit shows if a group has an unacknowledged alarm. For example, if bit one is ON there is an unacknowledged alarm in group one.
%SR182	This register is a bit-mapped indicator of the advanced alarm manager. Each bit shows if a group has an active alarm. For example, if bit one is ON there is an active alarm in group one.
%SR183 (only for XLt)	SYS_BEEP System Beep Enable (0=disabled; 1=enabled)
%SR184 (only for XLt)	USER_BEEP Software configurable (0=OFF; 1=ON)

For additional information on system bits and registers, refer to the on-line help found in Cscope.

13.3 Register Map for XLe/XLt I/O

Table 13.3 – I/O Register Map	
Registers	Description
Registers	Description
%I1 to %I24	Digital Inputs
%I25 to %I31	Reserved
%I32	Output Fault
%Q1 to %Q16	Digital outputs
%Q17	Clear HSC1 accumulator to 0
%Q18	Totalizer: Clear HSC2 Quadrature 1-2: Accumulator 1 Reset to max – 1
%Q19	Clear HSC3 accumulator to 0
%Q20	Totalizer: Clear HSC4 Quadrature 3-4: Accumulator 3 Reset to max – 1
%Q21 to %Q32	Reserved
%AI1 to %AI4	Analog inputs
%AI5, %AI6	HSC1 Accumulator
%AI7, %AI8	HSC2 Accumulator
%AI9, %AI10	HSC3 Accumulator
%AI11, %AI12	HSC4 Accumulator
%AQ1, %AQ2	PWM1 Duty Cycle
%AQ3, %AQ4	PWM2 Duty Cycle
%AQ5, %AQ6	PWM Prescale
%AQ7, %AQ8	PWM Period
%AQ9 to %AQ14	Analog outputs
Note: Not all XLe or XLt units contain the I/O listed in this table.	

13.4 Resource Limits

Table 13.3- Resource Limits	
Resource	Value
%S	13
%SR	192
%T	2048
%M	2048
%R	9999
%K	10
%D	1023
%I	2048
%Q	2048
%AI	512
%AQ	512
%IG	64
%QG	64
%AIG	32
%AQG	32
Network Ports	CsCAN (Optional depending on model.)
Controllers Per Network	253
Keypad	20 keys (10 fn keys and 4 soft keys)
Display	128x64 LCD Backlit, monochrome for XLe 160x128 LCD Backlit, monochrome for XLt
Screen Memory	1 M
User Screens	1023
Data Fields Per User Screen	50
Ladder Code	256 k

NOTES

CHAPTER 14: CSCAPE CONFIGURATION

14.1 Overview

XLe/XLt hardware is programmed with a Windows based PC application called Cscape. This application can be used to program, configure, monitor and debug all aspects of the XLe/XLt unit. Please see the on-line help provided with Cscape for additional details.

14.2 Cscape Status Bar

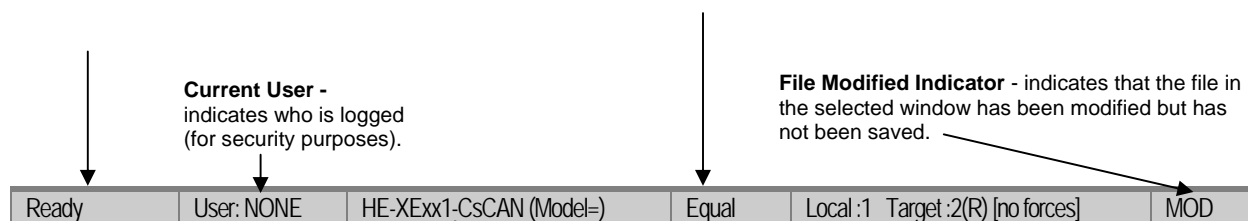
When the XLe/XLt is connected to a PC using Cscape software a Status Bar appears at the bottom of the screen. The Cscape Status Bar can be used to determine if communications have been established between the XLe/XLt and the Cscape program. Components of the Cscape Status Bar are explained below.

Message Line -

The contents of these messages are context sensitive. The Message line can be empty.

Equal Indicator – indicates whether the current program in Cscape is equal to the program stored in the Target Controller.

- If **Equal**, the program in Cscape is the same as the program stored in the Target Controller.
- If **Not Equal**, the program in Cscape is not the same as the program stored in the Target Controller.
- If **Unknown**, there may have been a change since the last time the program in Cscape was compared to the Target Controller.



Controller Model - Network (Model Confirmation)

- **Controller Model** indicates the controller model for which the program in Cscape is configured.
- **Network** indicates the type of network that the program in Cscape expects to use (e.g., CsCAN).
- **(Model Confirmation)** provides the following indications:
 - **(Model=)** - the actual Target Controller matches the configured Controller Model and Network.
 - **(Model Not=)** – the actual Target Controller does not match the configured Controller Model and Network.
 - **(Model ?)** – there may have been a change since the last time the Target Controller was compared to the configured Controller Model and Network.

Communications Status - indicates the current status of the "pass through" Connector.

- **Local: xx** – indicates the Network ID of the XLe/XLt to which the Cscape program is physically connected through its serial port. It can serve as a pass through device to other nodes on the network.
- **Target: yy(R)** – indicates the Network ID of the device with which the Cscape program is exchanging data.
Note: The **Local** unit and **Target** unit can be the same unit or they can be separate units.

The following are status indicators:

- (R) – Running
- (D) - Do I/O
- (I) – Idle
- (?) – Cscape is not communicating with the remote unit.
- [no forces] – indicates no I/O has been forced.

14.3 Establishing Communications

The main method for communicating between Cscape and an XLe/XLt is RS-232 serial. The XLe/XLt can communicate with Cscape using USB to serial adapters, Ethernet, CAN (CsCAN) or modems. For communications other than RS-232 serial please refer to the manual that ships with the adapter hardware being used for programming.

Start by configuring Cscape to use the correct communications port. This can be done using the **Tools | Options | Communication Port** dialog in Cscape.

Next connect the PC serial port to the port labeled MJ1 on the XLe/XLt.

If communications are successful, the target indicator should show the mode of the controller **Target: yy(R)** as shown in the status section above.

If the controller is not communicating you may need to set the target ID of the controller in Cscape or on the unit. The **Target ID** allows directing communications to a particular unit when multiple units are connected via a CsCAN network. Units without CsCAN network ports respond to any network ID and do not require the ID to be configured.

To check or change the ID on the XLe/XLt, press the UP and DOWN keys on the XLe/XLt simultaneously to enter the system menu. The first item in the menu is **Set Network ID**. Pressing **Enter** allows you to view or modify the ID of the unit.

To change the Target ID of Cscape use the **Controller | Set Target Network ID** dialog.

14.4 Models supported

At the time of printing Cscape 8.50 supports all models and options offered in the XLe/XLt line. For the latest version of Cscape or compatibility information, contact Technical Support (page 83).

14.5 Configuration

An overview of configuration:

- (1) Start the configuration by selecting the **Controller | I/O Configure** menu item.
- (2) If the XLe/XLt is connected to the PC press the **Auto Config System** button to automatically detect the Base model, I/O and any communication options.
- (3) If the XLe/XLt is not connected press the **Config** button to the right of the top of the unit. This allows the base CPU to be selected.
- (4) Select either **XLe/XLt Cscan** or **XLe/XLt No Net** from the type drop down box.
- (5) Once the type of XLe/XLt is selected, the model # drop down box will provide the XLe/XLt model numbers from which to choose from.
- (6) Once the XLe/XLt CPU is selected, press **OK** to exit the dialog and configure the I/O that is present in the first slot.
- (7) The I/O configure dialog (Specifically the **Module Setup** tab) provides 4 buttons to configure all of the I/O. Go through each area of I/O and configure it.
- (8) Once done configuring the I/O OK out of configuration dialogs.

Configuring the XLe/XLt I/O has four main portions that are covered in this chapter. For additional information on I/O, refer the chapters covering General I/O (page 33) or High Speed I/O (page 39) in this manual.

The four areas of I/O configuration are:

- Digital in / HSC
- Digital out / PWM
- Analog in
- Analog out

14.6 Digital Input / HSC Configuration

The following figure illustrates the **Digital Input / HSC Configuration** dialog.

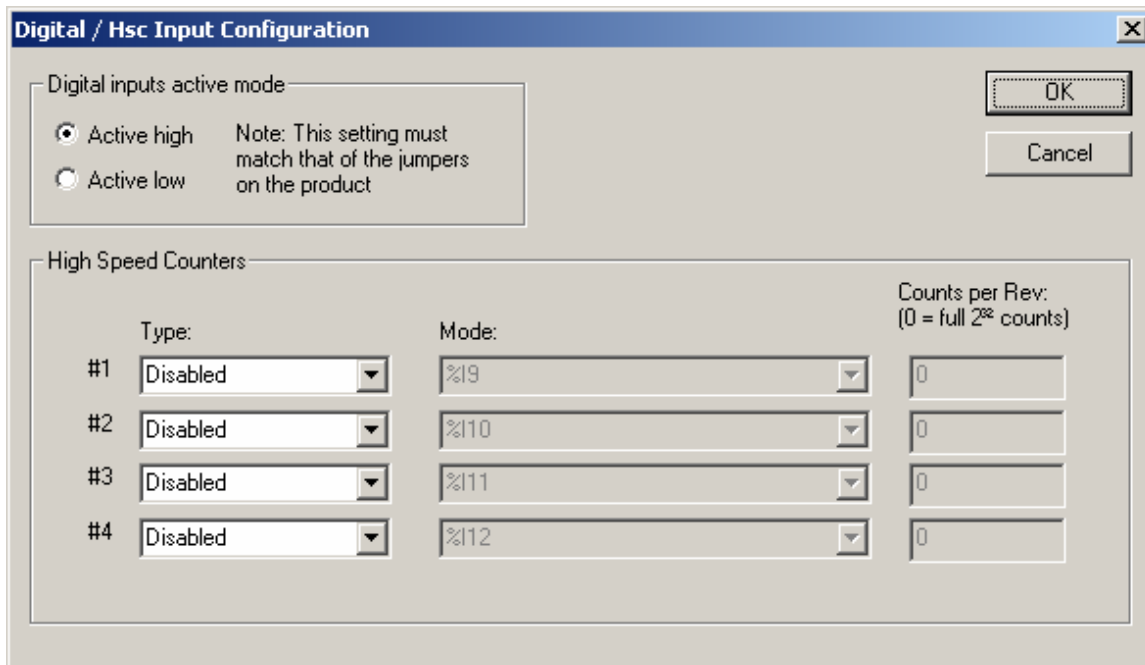


Figure 14.1 – Digital Input / HSC Configuration Dialog

The Active mode group box allows the user to select if inputs are active high (Positive logic) or active low (Negative logic). It is important that this setting match what the jumper settings are on the hardware.

The High Speed Counters group box contains all of the windows that are used for configuring the 4 available high speed counters on the XLe/XLt. In configuring a counter, the user needs to set the type, mode, and counts per rev.

The type drop down includes the following options:

- Disabled
- Frequency
- Totalize
- Pulse
- Quadrature
- Marker (Only available in counter #3 if counter #1 is set to quadrature.)

The mode drop-down items are set according to the type selection. The **Counts Per Rev.** window is enabled/disabled according to the type selection as well. The following table shows what is available with each type selection.

Table 14.1- Count Per Rev		
Type	Mode	Counts Per Rev.
Disabled	Grayed out. Displays %Ix to indicate to the user that the input devoted to the high speed counter is just dumb I/O, and its location RELATIVE to the I/O map	Grayed out
Frequency	Enabled. Contains the following: 1 sec. 100 msec. 10 msec. Scan resolution	Grayed out
Totalize	Enabled. Contains the following: Rising edge Falling edge	Enabled. Value can be 0 → 0xffffffff (Hex)
Pulse	Enabled. Contains the following: Width high, 1µsec. Counts Width low, 1µsec. Counts Period rising edges, 1µsec. Counts Period falling edges, 1µsec. Counts	Grayed out
Quadrature	Enabled. Contains the following: 1 leads 2, count up 1 leads 2, count down	Enabled. Value can be 0 → 0xffffffff (Hex)
Marker	Enabled. Only available in counter #3 and only when counter #1 is set to quadrature. Contains the following: Async, reset on rising edge Async, reset on falling edge Async, reset on both edges High, reset on 1 rising Low, reset on 1 rising High, reset on 1 falling Low, reset on 1 falling High, reset on 2 rising Low, reset on 2 rising High, reset on 2 falling Low, reset on 2 falling	Grayed out

14.7 Digital Output / PWM Configuration

The following figure illustrates the **Digital Output / PWM Configuration** dialog.

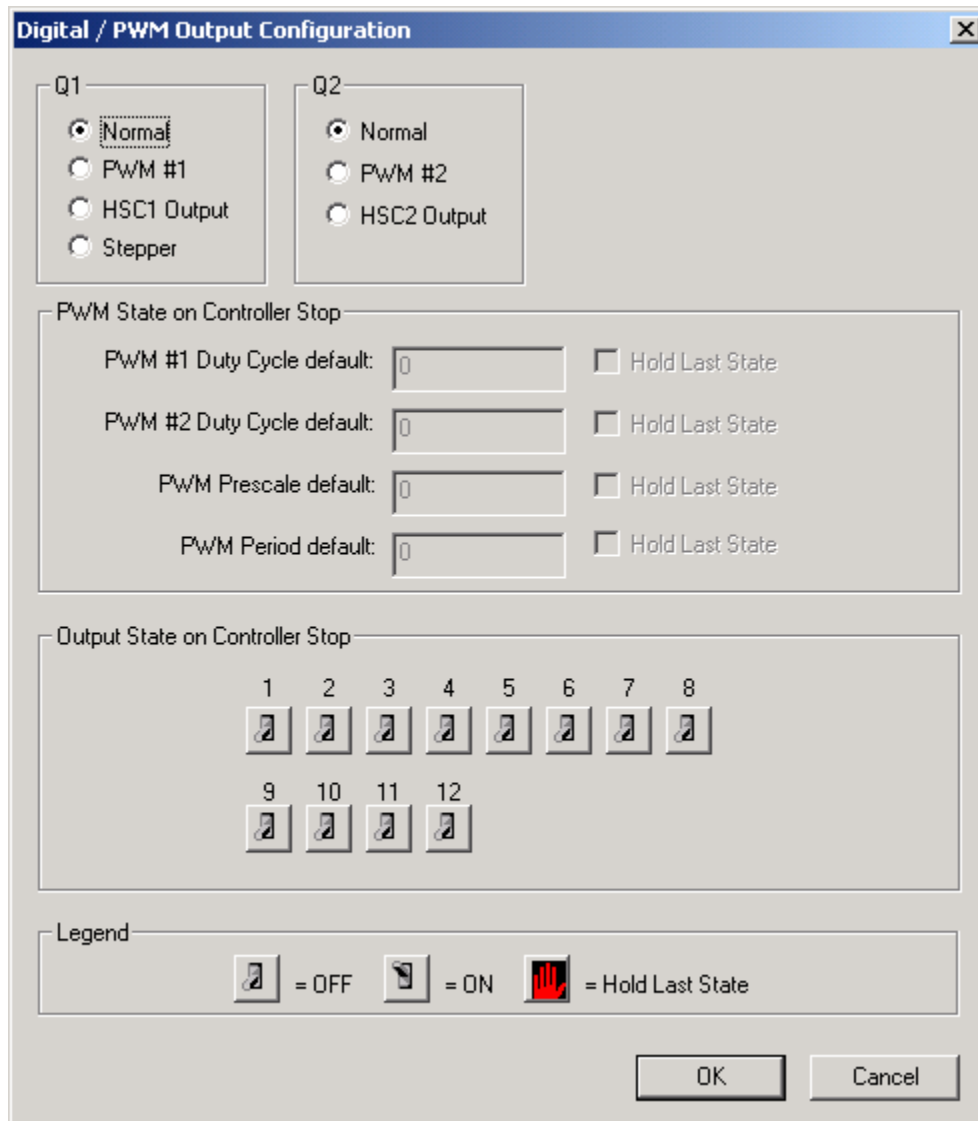


Figure 14.2 – Digital Output / PWM Configuration Dialog

The **Q1** and **Q2** group boxes allow the user to specify the operation of the multi-function outputs.

The **PWM State On Controller Stop** group box contains items that allow the user to specify how the PWM outputs behave when the controller is stopped. These items can either hold their value or default to some value when the controller is stopped.

Note that the PWM outputs are set to the OFF state at power-up and during program download and remain in that state until the unit is placed in RUN

The **Output State On Controller Stop** group box contains items to allow the user to specify how the remaining digital outputs behave when the controller is stopped. These items can either hold their value or default to some value when the controller is stopped.

14.8 Analog Input Configuration

The following figure illustrates the **Analog Input Configuration** dialog.

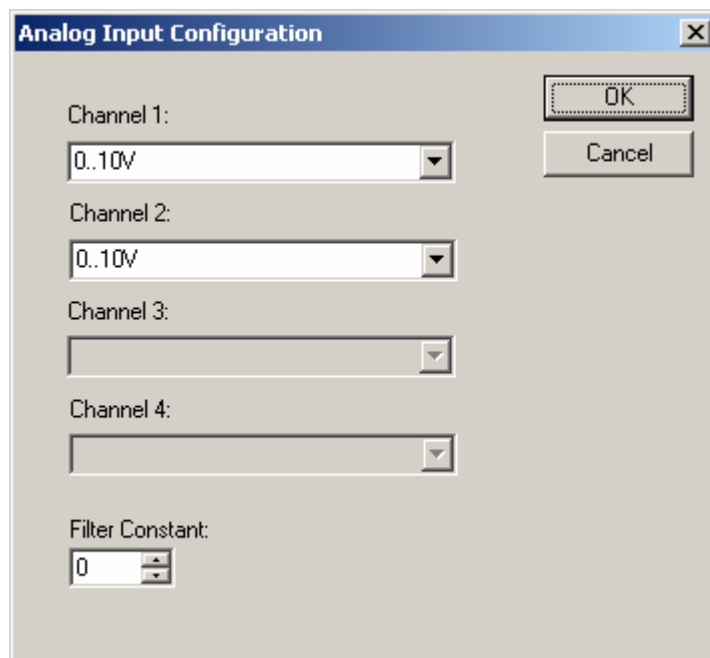


Figure 14.3 – Analog Input Configuration Dialog

The **Channel x** drop down windows allow the user to specify the mode for each analog input to operate. The **Channel x** drop down windows are enabled/disabled according to which model is being configured. All of the models have the following modes available:

- 0..10V
- 0..20mA
- 4..20mA

On model 005, channels 3 and 4 also have the following modes available:

- 100mV
- PT100 DIN RTD, 1/20°C
- Type J Thermocouple, 1/20°C
- Type K Thermocouple, 1/20°C
- Type N Thermocouple, 1/20°C
- Type T Thermocouple, 1/20°C
- Type E Thermocouple, 1/20°C
- Type R Thermocouple, 1/20°C
- Type S Thermocouple, 1/20°C
- Type B Thermocouple, 1/20°C

The **Filter Constant** provides filtering to all channels.

14.9 Analog Output Configuration

The following figure illustrates the **Analog Output** Configuration dialog.

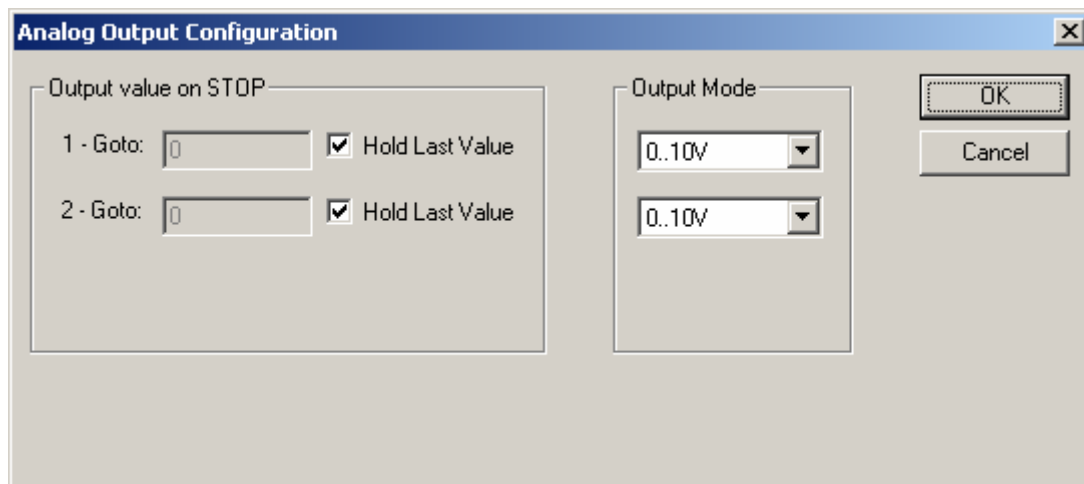


Figure 14.4 – Analog Output Configuration Dialog

The **Output value on Stop** group box contains items that allow the user to specify how the analog output channels behave when the controller is stopped. The outputs can either hold their value or default to a value when the controller is stopped.

The **Output Mode** group box allows the user to select the operating modes for each of the analog outputs. The modes include the following:

- 0..10V
- 0..20mA
- 4..20mA

NOTES

CHAPTER 15: MAINTENANCE

15.1 Firmware Updates

The XLe/XLt products contain field updatable firmware to allow new features to be added to the product at a later time. Firmware updates should only be performed when a new feature or correction is required.

Warning: Firmware updates are only performed when the equipment being controlled by the XLe/XLt is in a safe, non-operational state. Communication or hardware failures during the firmware update process can cause the controller to behave erratically resulting in injury or equipment damage. Make sure the functions of the equipment work properly after a firmware update before returning the device to an operational mode.

Steps for updating the firmware:

1. Establish communication between Cscape and the controller using a direct serial connection to MJ1.
2. Make sure your application is available on your PC or upload the application.
3. Make sure the machinery connected to the XLe/XLt is in a safe state for firmware update (see warning above).
4. Start the firmware update by selecting File | Firmware Update Wizard.
5. The correct product type should be selected, if it is not select the type of controller from the drop down list.
6. Press the start button
7. Wait for the firmware update to complete.
8. If there is a communication failure check the cable, connections and comm. port setting and try again.
9. Firmware updates typically delete the user applications to ensure compatibility. You will need to reload your application.
10. Test the operation of the equipment with the new firmware before returning the XLe/XLt system to an operation mode.

15.2 Backup Battery

The XLe/XLt contains a run-time battery monitor that checks the voltage of the internal lithium battery. This battery is used to run the real-time clock and maintains retentive registers when power is disconnected.

Under normal conditions the battery in the XLe/XLt should last 7 to 10 years. Higher operating temperatures or variations in batteries may reduce this time.

15.2.1 *Indications the battery needs replacing*

The XLe/XLt indicates the battery is low, failed or missing in a variety of ways. At power-up, an error message is displayed indicating the low or missing battery. The user program can monitor the battery using %SR55.13. This bit will turn on if the battery is low or missing. The system menu also contains a battery status message under the diagnostics sub-menu (see the chapter on System Settings and Adjustments).

15.2.2 Battery Replacement

Warning: Lithium Batteries may explode or catch fire if mistreated
Do not recharge, disassemble, heat above 100 deg.C (212 deg.F) incinerate, or puncture.

Warning: Disposal of lithium batteries must be done in accordance with federal, state, and local regulations. Be sure to consult with the appropriate regulatory agencies *before* disposing batteries. In addition, do not re-charge, disassemble, heat or incinerate lithium batteries.

Warning: Do not make substitutions for the battery. Be sure to only use the authorized part number to replace the battery.

The XLe/XLt uses a CR2450B coin lithium battery produced by a variety of manufacturers.

Below are the steps to replace the battery.

1. Make sure the user program and any data stored in retentive memory is backed up.
2. Disconnect all power from the XLe/XLt unit including I/O power.
3. Remove the four screws on the back of the XLe/XLt unit and remove the back cover.
4. Remove the I/O board (if present) by lifting it straight up.
5. Remove the old battery. It may require a small flat blade screwdriver to lift it from the holder.
6. Dispose of the battery properly; see the above warning on disposal regulations.
7. Slide the new battery into the holder. Make sure the battery is inserted with the proper polarity. The top tab of the battery holder should contact the positive (+) terminal of the battery.
8. Place the I/O board back into the case by aligning the connecting and pressing straight down.
9. Place the back cover back on the unit.
10. Place the screw back into the hole and turn the screw slowly counter clockwise until "clicks" into the threads. This will prevent the screw from being cross threaded. Now turn the screw clockwise until the cover is firmly secured. Repeat this process for all four (4) screws.
11. Apply power to the unit. Check that the battery error is no longer reported. If the unit still reports the error, remove the battery immediately and contact Technical Support (page 83).

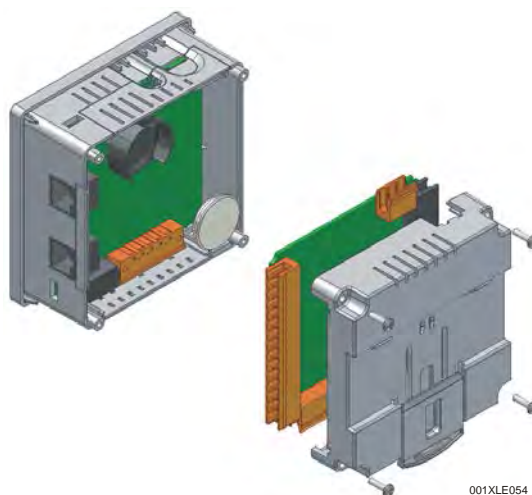


Figure 15.1 – Replacing the back-up battery

CHAPTER 16: TROUBLESHOOTING / TECHNICAL SUPPORT

CHAPTER 16 provides commonly requested **troubleshooting information and checklists** for the following topics.

- Connecting to the XLe/XLt controller
- Local controller and local I/O
- CsCAN Network
- Removable media

In the event that this information is not what you need, please contact Technical Support at the locations indicated at the end of this chapter.

16.1 Connecting to the XLe/XLt

Cscape connects to the local controller automatically when the serial connection is made. The status bar below shows an example of a successful connection. This status bar is located in the bottom right hand corner of the Cscape window.

Local:253 Target:253(R) [no forces]

In general the **Target** number should match the **Local** number. The exception to this is when the controller is being used as a "pass through" unit where other controllers on a CsCAN network could be accessed through the local controller.

Determine connection status by examining feedback next to **Local & Target** in the status bar of Cscape.

Local: ###	If a number shows next to Local then communication is established to the local controller.
Local: No Port	Cscape is unable to access the COM port of the PC. This could mean that Cscape is configured for a COM port that is not present or that another program has control of the COM port. Only one Cscape window can access a port at a time. Subsequent instances of Cscape opened will indicate No Port.
Local: No Com	Cscape has accessed a PC COM port, but is not communicating with the controller. This typically occurs when the controller is not physically connected.
Local: ???	Unknown communication error. Close Cscape, power cycle the controller and reopen Cscape with a blank project. Check Local.
Target: #(I,R,D)	If I (idle), R (run), or D (do I/O) shows next to Target number then communication is established to the target controller.
Target: #(?)	Communication is not established to the target controller. Check node ID of controller and set Target to match. Make sure local connection is established.

16.1.1 Connecting Troubleshooting Checklist

1. Programming and debugging must use MJ1.
2. Controller must be powered up.
3. Assure that the correct COM port is selected in Cscape.
Tools/Options/Communications Port.
4. Assure that a straight through (non null modem) serial cable is being used between PC and controller.
5. Check that a Loaded Protocol or ladder is not actively using MJ1. Taking the controller out of run mode from the System Menu on the controller will make MJ1 available to Cscape.
6. Make sure the COM port of the PC is functioning. An RS-232 serial loopback and Microsoft HyperTerminal can determine positively if the COM port is working. Or connect to an alternate device to determine if the port is working.
7. Successful communications with USB-to-serial adapters vary. If in doubt, Horner APG offers a USB to serial adapter. Part number HE500USB600.
8. XLe/XLt units without Ethernet must use MJ1 for programming and debugging. If Ethernet is installed it can be selected as the programming port. The selection is made in the controller's System Menu. If there are difficulties connecting, make sure that the default programming port is set correctly with the connection method being attempted.

16.2 Local Controller and Local I/O

The system menu provides the following status indications that are useful for troubleshooting and system maintenance.

- Self-test results, diagnostics.
- RUN and OK status
- Network status and usage
- Average logic scan rate
- Application memory usage
- Loaded firmware versions
- Loaded protocols
- Removable media access

To view the system menu, press the UP and DOWN arrow keys simultaneously. See CHAPTER 11 for full details on the system menu diagnostic capabilities.

16.2.1 Local I/O Troubleshooting Checklist

1. Verify the controller is in RUN mode.
2. Check diagnostics to insure controller passed self-tests.
View diags in System Menu or in Cscape, click; Controller/Diagnostics
3. Check data sheets to insure proper wiring.
4. Insure that hardware jumpers and software configuration for I/O match.
5. Check data sheets for voltage and current limits.
6. Take ladder out of the picture. From Cscape set controller to "Do I/O" mode. In this mode inputs can be monitored and outputs set from a data watch window in Cscape without interference from the ladder program. Some I/O problems are only a result of a mistake in the ladder program.

WARNING: Setting outputs ON in Do I/O mode can result in injury or cause machinery to engage in an unsafe manner depending on the application and the environment.

16.3 CsCAN Network

For complete information on setting up a CsCAN network, refer to CAN Networks manual (MAN0799) by visiting our website (page 83) for the address to obtain documentation and updates.

Network status, node ID, errors, and baud rate in the controller system menu are all in reference to the CsCAN network. These indications can provide performance feedback on the CsCAN network and can also be used to aid in troubleshooting. Refer to CHAPTER 11 for full details on the system menu.

16.3.1 CsCAN Network Troubleshooting Checklist

1. Use the proper Belden wire type or equivalent for the network as specified in MAN0799.
2. The XLe/XLt does not provide 24VDC to the network. An external voltage source must be used for other devices such as SmartStix I/O.
3. Check voltage at both ends of the network to insure that voltage meets specifications of attached devices.
4. Proper termination is required. Use 121-ohm (or 120-ohm) resistors at each end of the network. The resistors should be placed across the CAN_HI and CAN_LO terminals.
5. Measure the resistance between CAN_HI and CAN_LO. If the network is properly wired and terminated there should be around 60 ohms.
6. Check for duplicate node ID's.
7. Keep proper wires together. One twisted pair is for V+ and V- and the other twisted pair is used for CAN_HI and CAN_LO.
8. Make sure the baud rate is the same for all controllers on the network.
9. Assure shields are connected at one end of each segment -- they are not continuous through the network.
10. Do not exceed the maximum length determined by the baud rate and cable type.
11. Total drop length for each drop should not exceed 6m (20 feet). A drop may include more than one node. The drop length adds to the overall network length.
12. Network should be wired in "straight line" fashion, not in a "star" pattern.
13. In applications requiring multiple power supplies, make sure the V- of all supplies is connected together and to earth ground at one place only.
14. In some electrically noisy environments it may be necessary to add repeaters to the network. Repeaters can be used to add additional nodes and/or distance to the network and protect the signal against noisy environments. The Horner APG repeater is part # HE200CGM100.

16.4 Removable Media

16.4.1 Basic Troubleshooting

Description	Action
XLe/XLt does not read media card.	The media card should be formatted with the XLe/XLt.
XLe/XLt will not download project file.	Make sure the project file is saved as a .pgm file and not a .csp file.

16.5 Technical Support Contacts

For manual updates and assistance, contact Technical Support at the following locations:

North America:

(317) 916-4274

www.heapg.com

email: techsppt@heapg.com

Europe:

(+) 353-21-4321-266

www.horner-apg.com

email: techsupport@hornerirl.ie

INDEX

- Accessories, 13
- Analog Inputs, 37
- Analog Outputs, 38
- Back Cover Removal, 33
- Battery
 - Backup, 78
 - Replacement, 79
 - Warnings, 79
 - When to Replace, 78
- CAN Comm
 - Cscape Programming, 26
 - I/O Expansion (Network I/O), 26
 - Ladder-Controlled, 26
 - Overview, 25
 - Ports, 25
 - Wiring, 25
- CE, 10
- Com Port Rediretor, 27
- Communication Options
 - Ethernet COM Module (XEC), 27
 - Modem COM Module (XMC), 28
 - Overview, 27
- Compliance
 - CE, 10
- Cscape Program
 - Via Serial Port, 24
- Cscape
 - Analog In Configuration, 75
 - Analog Out Configuration, 76
 - Configuration Procedures, 71
 - Count per Rev, 73
 - Digital In / HSC Configuration, 72
 - Digital Out / PWM Configuration, 74
 - Establishing Communications, 71
 - Models Supported, 71
 - Overview, 70
 - Status Bar, 70
- Devices to Connect to XLe, 12
- Digital Inputs, 37
- Dimensions, 17
- Duty Cycle Examples, 49, 50
- Ethernet COM Module
 - XEC, 27
- Features, 12
- Firmware Updates, 78
- General I/O
 - Overview, 33
- Ground
 - Testing for Good, 21
- Ground Specification, 21
- Grounding
 - Locations of Information, 10
- Grounding Definition, 21
- High Speed
 - Configure Inputs, 39
 - Frequency, 39
- High Speed / PWM
 - Overview, 39
- I/O Register map for XLe, 67
- Jumpers Example, 34**
- Map
 - Major Tasks, Key Chapters, 8
- Micro SD Cards, 29
 - Installing / Removing, 29
- Micro SD System, 29
- Model / I/O Overview, 34
- Modem COM Module Option, 28
- Mounting Orientation, 16
- Mounting Requirements, 15
 - DIN Rail Mounting, 16
 - Panel Door Mounting, 15
- Panel Box
 - Clearances, 18
 - Grounding, 18
 - Noise, 19
 - Orientation, 19
 - Temperature, 18
- Panel Box Shock and Vibration, 19
- Panel Cut-out, 17
- Panel Design Checklist, 19
- Panel Layout / Clearances, 18
- Primary Power Port, 22
- Pulse, 40
- PWM
 - Examples, 49, 50
 - Frequency Formula, 45, 47
 - Highest Usable Frequency 65kHz, 50
 - Maximum Usable Frequency 65kHz, 50
 - Registers, 49
- Quadrature, 41
- References / Useful documents, 14
- Register Map for XLe I/O, 67
- Registers
 - %S / %SR, 66
 - Definitions, 65
 - I/O, 67
 - Resource Limits, 68
- Relay Outputs, 35
- Removable Media
 - Load / Save Applications, 30
 - Log Data, 30
 - Overview, 29
 - Save Applications XLe, 30
 - Save Applications XLT, 30

INDEX**PAGE 85**
MAN0878-02-EN

View / Capture, 31
 Removable Media Manager, 30
 Removable Media XLe, 58
 Removable Media XLt, 59
 RS-485 Biasing, 24
 RS-485 Termination, 24
 Safety Warnings, Guidelines, 9
 Serial Comm
 Cscope Programming, 24
 Downloadable Protocols, 24
 Ladder-Controlled, 24
 Overview, 23
 Ports, 23
 Wiring, 23
 Set Beeper - XLt, 58
 Solid-State Digital Outputs, 35
 Sub-Menus, 51
 System Menu
 Details, 53
 Navigate / Edit, 52
 Sytem Menu
 Overview, 51

Technical Support
 Contacts, 83
 Totalize, 39
 Toubleshooting
 Connecting Checklist, 81
 Troubleshooting
 Common problems, 80
 CsCAN Checklist, 82
 CsCAN Network, 82
 Local Controller / I/O, 81
 Local I/O Checklist, 81
 Removable Media, 83
 Universal Analog Inputs, 38
 User Interface
 Editable Screen Objects, 62
 Ladder Based Navigation, 62
 Screen Navigation, 61
 Visual Overview of XLe and Topics, 11
 Where to Find Information, 11
 XEC, 27
 XMC, 28

Table of Figures

Figure 2.1 – Visual Overview of XLe/XLt and Topics of Interest Covered in the User Manual.....	11
Figure 2.2 – Visual Overview of Types of Devices that can be connected to XLe/XLt.....	12
Figure 3.1 – Panel Mounting of the XLe/XLt and Close-up View of Back	15
Figure 3.2 – DIN Rail Mounting of the XLe/XLt.....	16
Figure 3.3 – Orientation of XLe/XLt OCS.....	16
Figure 3.4 – XLe/XLt Panel Cut-out	17
Figure 3.5 – XLe/XLt Dimensions	17
Figure 4.1 - Two-Point Ground Connection Test	21
Figure 4.2 - Power Connector (Primary Power Port)	22
Figure 4.3 - As Viewed Looking at the XLe/XLt	22
Figure 5.1 – MJ Serial Port Connector.....	23
Figure 6.1 - NET1 Port Connector	25
Figure 8.1 – Installing Removable Memory Card.....	29
Figure 9.1 – Removing the Back Cover	33
Figure 9.2 – Example Jumper Diagram	34
Figure 9.3 – Typical Output Wiring	35
Figure 11.1 – System Menu (XLe)	51
Figure 11.2 – System Menu (XLt)	52
Figure 12.1 – Typical Screen Jump Object (XLe)	61
Figure 12.2 – Typical Screen Jump Object (XLt)	61
Figure 12.3 – Force and Switch Coils in Ladder Programming	62
Figure 14.1 – Digital Input / HSC Configuration Dialog	72
Figure 14.2 – Digital Output / PWM Configuration Dialog	74
Figure 14.3 – Analog Input Configuration Dialog	75
Figure 14.4 – Analog Output Configuration Dialog	76
Figure 15.1 – Replacing the back-up battery	79

Information in this document is subject to change without notice. This document is the property of Horner APG and shall not be modified as to content unless specifically authorized.

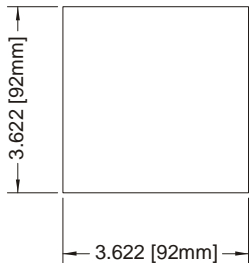
**XLE OCS Model:****HE-XE100 / HE-XE220C100 / HE-XE220C000****1 SPECIFICATIONS**

Specifications	
General Specifications	
Required Power (Steady State)	130 mA @ 24 VDC
Required Power (Inrush)	30A for 1 ms @ 24 VDC
Primary Power Range	10 – 30 VDC
Relative Humidity	5 to 95% Non-condensing
Clock Accuracy	+/- One Minute/Month at 20C
Operating Temperature	0°C to +50°C
Terminal Type	Screw Type, 5 mm Removable
Weight	12 oz. (340.19 g)
CE	See Compliance Table at :
UL	http://www.heapg.com/Support/compliance.htm

2 Panel Cut-Out and Dimensions

Note: Max. panel thickness: 5 mm.

Refer to the User Manual for panel box information and a handy checklist of requirements.

Note: The tolerance to meet NEMA standards is $\pm 0.005"$ (0.1 mm).

001XLE002



3.780 [96.0 mm]

3.780 [96.0 mm]

Note – Your keypad overlay appearance may differ. Standard US/EU overlays pictured here for example.

2.264 [57.5 mm]

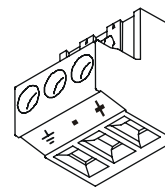
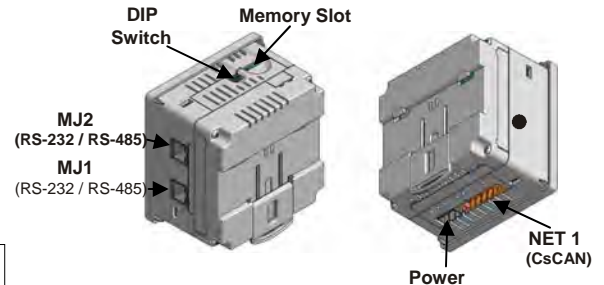
3 Ports / Connectors / Cables**Note:** The case of the XLe is black, but for clarity, it is shown in a lighter gray color.

To Remove Back Cover:
Unscrew 4 screws located on the back of the unit and remove back cover.

CAUTION: Do not over tighten screws when replacing back cover.

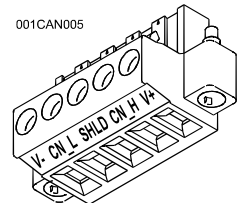
Memory Slot:
Uses **Removable Memory** for data logging, screen captures, program loading and recipes.
Horner Part No.: HE-MC1

Serial Communications:
MJ1: (RS-232 / RS-485) Use for Cscape programming and Application-Defined Communications.
MJ2: (RS-232 / RS-485) Use for Application-Defined Communications.

**Power Connector****Power Up:**

Connect to Earth Ground.
Apply 10 - 30 VDC.
Screen lights up.

Torque rating 4.5 – 7 Lb-In
(0.50 – 0.78 N-m)

**CAN Connector**

Use the CAN Connector when using CsCAN network.

Torque rating 4.5 – 7 Lb-In
(0.50 – 0.78 N-m)

Serial Communications:

MJ1: (RS-232 / RS-485) Use for Cscape programming and Application-Defined Communications.

MJ2: (RS-232 / RS-485) Use for Application-Defined Communications.

Pin	MJ1 Pins		MJ2 Pins	
	Signal	Direction	Signal	Direction
8	TXD	OUT	TXD	OUT
7	RXD	IN	RXD	IN
6	0 V	Ground	0 V	Ground
5*	+5 60mA	OUT	+5 60mA	OUT
4	RTS	OUT	TX-	OUT
3	CTS	IN	TX+	OUT
2	RX- / TX-	IN / OUT	RX-	IN
1	RX+ / TX+	IN / OUT	RX+	IN

* +5Vdc 60mA Max on XLe Rev E and later

4 Wiring and Jumpers

Wire according to the type of inputs / outputs used, and select the appropriate jumper option.

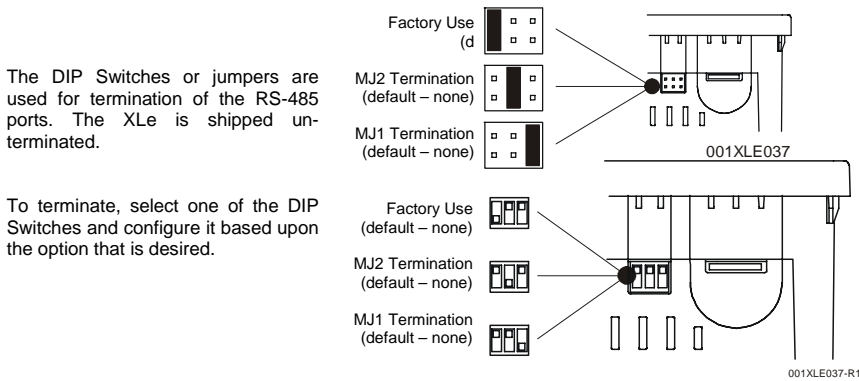
- Use Only Copper Conductors in Field Wiring, 60/75° C

Wiring Specifications

•For CAN wiring, use the following wire type or equivalent:
Belden 3084, 24 AWG (0.2 mm²) or larger.

4.1 External DIP Switch Settings (or Jumpers Settings)

As seen when looking at the top of the XLe unit :



5 MJ2 Pinouts in Half and Full Duplex Modes

Pin	MJ2 Pins	
	Signal	Direction
8	TXD	OUT
7	RXD	IN
6	0 V	Ground
5*	+5 60mA	OUT
4	TX-	OUT
3	TX+	OUT
2	TX-/RX-	IN/OUT
1	TX+/RX+	IN/OUT

MJ2 Half Duplex Mode

* +5Vdc 60mA Max on XLe Rev E and later

Pin	MJ2 Pins	
	Signal	Direction
8	TXD	OUT
7	RXD	IN
6	0 V	Ground
5*	+5 60mA	OUT
4	TX-	OUT
3	TX+	OUT
2	RX-	IN
1	RX+	IN

MJ2 Full Duplex Mode

6 Safety

When found on the product, the following symbols specify:



Warning: Electrical Shock Hazard.



Warning: Consult user documentation.

WARNING: To avoid the risk of electric shock or burns, always connect the safety (or earth) ground before making any other connections.

WARNING: To reduce the risk of fire, electrical shock, or physical injury it is strongly recommended to fuse the voltage measurement inputs. Be sure to locate fuses as close to the source as possible.

WARNING: Replace fuse with the same type and rating to provide protection against risk of fire and shock hazards.

WARNING: In the event of repeated failure, do not replace the fuse again as a repeated failure indicates a defective condition that will not clear by replacing the fuse.

WARNING: Only qualified electrical personnel familiar with the construction and operation of this equipment and the hazards involved should install, adjust, operate, or service this equipment. Read and understand this manual and other applicable manuals in their entirety before proceeding. Failure to observe this precaution could result in severe bodily injury or loss of life.

•All applicable codes and standards need to be followed in the installation of this product.

•Adhere to the following safety precautions whenever any type of connection is made to the module:

- Connect the safety (earth) ground on the power connector first before making any other connections.
- When connecting to electric circuits or pulse-initiating equipment, open their related breakers.
- Do not make connections to live power lines.
- Make connections to the module first; then connect to the circuit to be monitored.
- Route power wires in a safe manner in accordance with good practice and local codes.
- Wear proper personal protective equipment including safety glasses and insulated gloves when making connections to power circuits.
- Ensure hands, shoes, and floor are dry before making any connection to a power line.
- Make sure the unit is turned OFF before making connection to terminals.
- Make sure all circuits are de-energized before making connections.
- Before each use, inspect all cables for breaks or cracks in the insulation. Replace immediately if defective.

6 Technical Support

For assistance and manual updates, contact Technical Support at the following locations:

North America:

(317) 916-4274

<http://www.heapg.com>

email: techsppt@heapg.com

Europe:

(+) 353-21-4321-266

<http://www.horner-apg.com>

email: techsupport@hornerirl.ie

Information in this document is subject to change without notice. This document is the property of Horner APG and shall not be modified as to content unless specifically authorized.



XLE OCS Model:
HE-XE102 / HE-XE220C112 / HE-XE220C012
12 Digital DC Inputs
4 Analog Inputs (Medium Resolution)
6 Digital Relay Outputs

1 Specifications

Specifications		
Digital DC Inputs		
Inputs per Module		12 including 4 configurable HSC inputs
Commons per Module		1
Input Voltage Range		12 VDC / 24 VDC
Absolute Max. Voltage		35 VDC Max.
Input Impedance		10 kΩ
Input Current	Positive Logic	Negative Logic
Upper Threshold	0.8 mA	-1.6 mA
Lower Threshold	0.3 mA	-2.1 mA
Max Upper Threshold		8 VDC
Min Lower Threshold		3 VDC
OFF to ON Response		1 ms
ON to OFF Response		1 ms
HSC Max. Switching Rate		10 kHz Totalizer/Pulse, Edges 5 kHz Frequency/Pulse, Width 2.5 kHz Quadrature
Digital Relay Outputs		
Outputs per Module		6 relay
Commons per Module		6
Max. Output Current per Relay		3 A at 250 VAC, resistive
Max. Total Output Current		5 A continuous
Max. Output Voltage		275 VAC , 30 VDC
Max. Switched Power		1250 VA, 150 W
Contact Isolation to XLe ground		1000 VAC
Max. Voltage Drop at Rated Current		0.5 V
Expected Life (See Derating section for chart.)		No load: 5,000,000 Rated load: 100,000
Max. Switching Rate		300 CPM at no load 20 CPM at rated load
Type		Mechanical Contact
Response Time		One update per ladder scan plus 10 ms
Analog Inputs, Medium Resolution		
Number of Channels		4
Input Ranges		0 - 10 VDC 0 – 20 mA 4 – 20 mA
Safe input voltage range		-0.5 V to +12V
Input Impedance (Clamped @ -0.5 VDC to 12 VDC)		<u>Current Mode:</u> 100 Ω <u>Voltage Mode:</u> 500 k Ω
Nominal Resolution		10 Bits
%AI full scale		32,000 counts
Max. Over-Current		35 mA
Conversion Speed		All channels converted once per ladder scan
Max. Error at 25°C (excluding zero) *can be made tighter (-0.25%) by adjusting the digital filter setting to 3.		4-20 mA 1.00% 0-20 mA 1.00% 0-10 VDC 1.50%*
Additional error for temperatures other than 25°C		TBD
Filtering		160 Hz hash (noise) filter 1-128 scan digital running average filter
General Specifications		
Required Power (Steady State)		130 mA @ 24 VDC
Required Power (Inrush)		30 A for 1 ms @ 24 VDC
Primary Power Range		10 – 30 VDC
Relative Humidity		5 to 95% Non-condensing
Clock Accuracy		+/- One Minute/Month at 20C

Note: Highest usable frequency for PWM output is 65 KHz

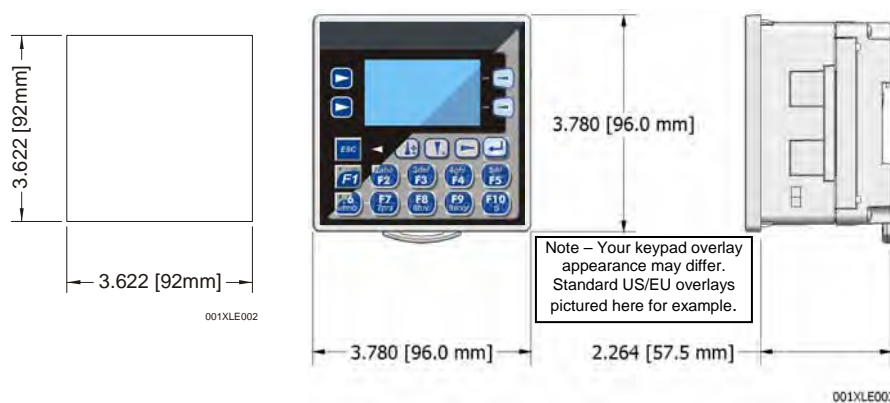
General Specifications continued

Operating Temperature	0°C to +50°C
Terminal Type	Screw Type, 5 mm Removable
Weight	12 oz. (340.19 g)
CE	See Compliance Table at http://www.heapg.com/Pages/TechSupport/ProductCert.html
UL	

2 Panel Cut-Out and Dimensions

Note: Max. panel thickness: 5 mm.

Refer to the XLe/XLt User Manual for panel box information and a handy checklist of requirements.

Note: The tolerance to meet NEMA standards is $\pm 0.005"$ (0.1 mm).

3 Ports / Connectors / Cables

Note: The case of the XLe is black, but for clarity, it is shown in a lighter gray color.

To Remove Back Cover:
 Unscrew 4 screws located on the back of the unit.
 Remove cover.

CAUTION: Do not over tighten screws when replacing the back cover.

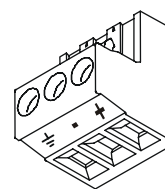
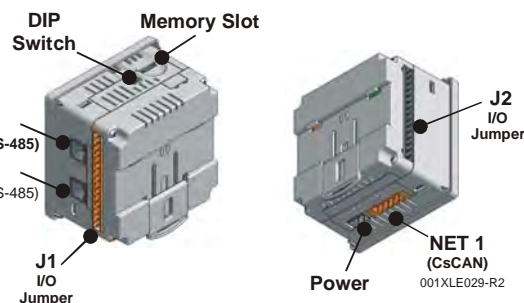
I/O Jumpers: (Not Shown):
 I/O Jumpers (JP) are located internally. To access, remove back cover of unit.

Wiring Connectors (J1 / J2):
 I/O Jumpers (JP1 / JP2), and External Jumpers (RS-485) are described in the **Wiring and Jumpers** section of this document.

Memory Slot:
 Uses **Removable Memory** for data logging, screen captures, program loading and recipes.
Horner Part No.: HE-MC1

Serial Communications:
MJ1: (RS-232 / RS-485) Use for Cscape programming and Application-Defined Communications.

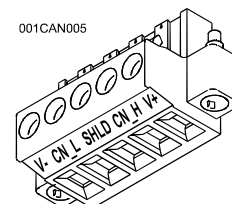
MJ2: (RS-232 / RS-485) Use for Application-Defined Communications.



Power Connector

Power Up:
 Connect to Earth Ground.
 Apply 10 - 30 VDC.
 Screen lights up.

Torque rating 4.5 - 7 Lb-In
 (0.50 - 0.78 N-m)



CAN Connector

Use the CAN Connector when using CsCAN network.

Torque Rating 4.5 - 7 Lb-In
 (0.50 - 0.78 N-m)

Serial Communications:

MJ1: (RS-232 / RS-485) Use for Cscape programming and Application-Defined Communications.

MJ2: (RS-232 / RS-485) Use for Application-Defined Communications.

Pin	MJ1 Pins		MJ2 Pins	
	Signal	Direction	Signal	Direction
8	TXD	OUT	TXD	OUT
7	RXD	IN	RXD	IN
6	0 V	Ground	0 V	Ground
5*	+5 60mA	OUT	+5 60mA	OUT
4	RTS	OUT	TX-	OUT
3	CTS	IN	TX+	OUT
2	RX- / TX-	IN / OUT	RX-	IN
1	RX+ / TX+	IN / OUT	RX+	IN

* +5 on XLe Rev E and later

4 Wiring and Jumpers

Wire according to the type of inputs / outputs used, and select the appropriate jumper option.

Wiring Specifications

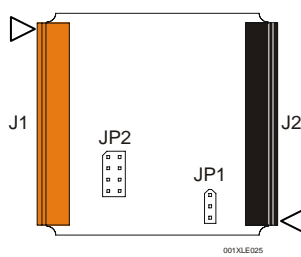
•For I/O wiring (discrete), use the following wire type or equivalent: Belden 9918, 18 AWG (0.8 mm²) or larger.

•For shielded Analog I/O wiring, use the following wire type or equivalent: Belden 8441, 18 AWG (0.8 mm²) or larger.

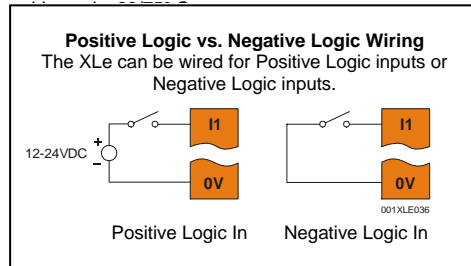
•For CAN wiring, use the following wire type or equivalent: Belden 3084, 24 AWG (0.2 mm²) or larger.

Use copper conductors in field

Location of I/O jumpers (JP) and wiring connectors (J1 and J2).



001XLE025

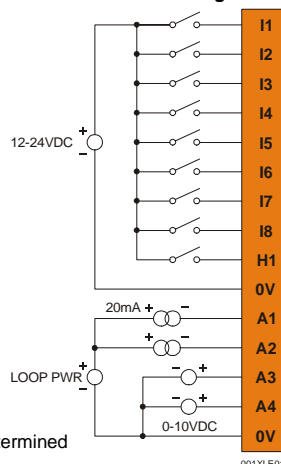


4.1 Wiring Examples

J1 Orange Terminal Connector	Name
I1	IN1
I2	IN2
I3	IN3
I4	IN4
I5	IN5
I6	IN6
I7	IN7
I8	IN8
H1	HSC1 / IN9
0V	Ground
A1	Analog IN1
A2	Analog IN2
A3	Analog IN3
A4	Analog IN4
0V	Ground

Note:
Loop Power requirements are determined by the transmitter specification.

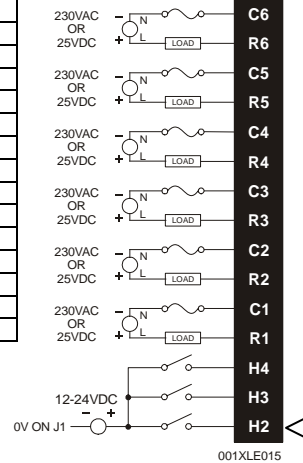
XE102 J1 Orange Positive Logic In Digital In / Analog In



4.1 Wiring Examples (continued)

J2 Black Terminal Connector	Name
C6	Relay 6 COM
R6	Relay 6 NO
C5	Relay 5 COM
R5	Relay 5 NO
C4	Relay 4 COM
R4	Relay 4 NO
C3	Relay 3 COM
R3	Relay 3 NO
C2	Relay 2 COM
R2	Relay 2 NO
C1	Relay 1 COM
R1	Relay 1 NO
H4	HSC4 / IN12
H3	HSC3 / IN11
H2	HSC2 / IN10

J2 Black Positive Logic Digital In / Relay Out



4.2 I/O Jumpers Settings (JP1 - JP2)

JP1 Digital DC In / HSC

Positive Logic Negative Logic



Default 001XLE026

JP2 Analog In (A1 - A4)

Current (20 mA) Voltage (10 V)



Default 001XLE027

Note:
When using JP2 (A1-A4), each channel can be independently configured.

Note: The Cscape Module Setup configuration must match the selected I/O (JP) jumper settings.

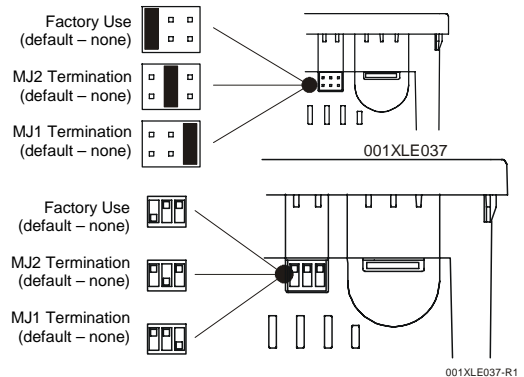
4.3 External DIP Switch Settings (or Jumpers Settings)

Some XLes have jumpers to set RS-485 port termination, though most use DIP Switches.

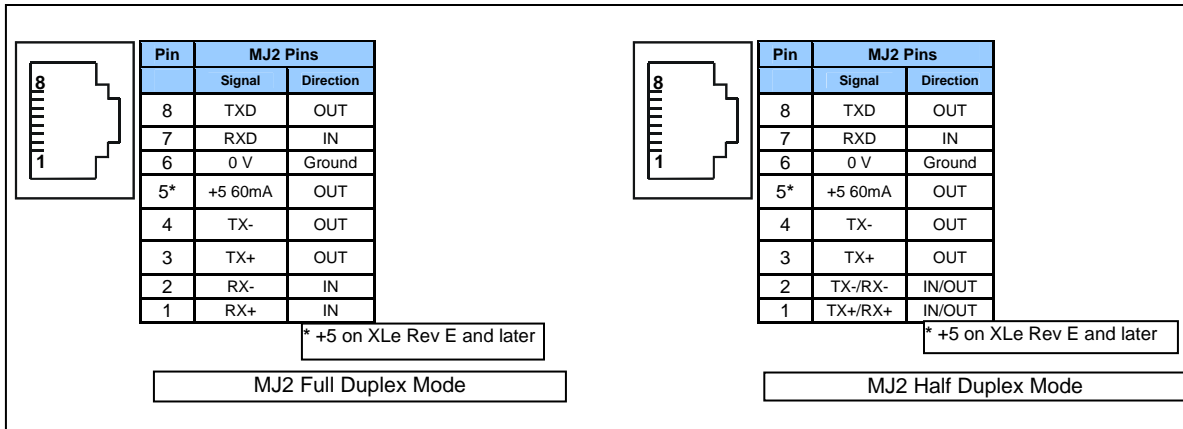
The External Jumpers or DIP Switches are used for termination of the RS-485 ports. The XLe is shipped un-terminated.

To terminate, select one of the jumpers shipped with the product and insert it based upon the option that is desired or, select the switch and configure based upon the option that is desired.

As seen when looking at the top of the XLE unit: Refer to Section 3 for the location of the DIP Switches (or External Jumpers).



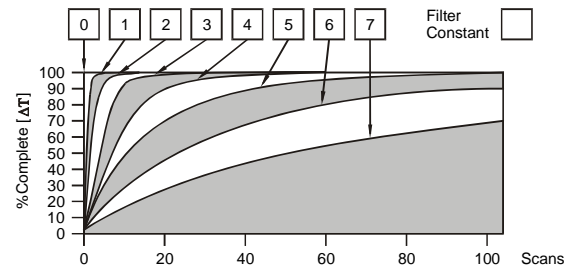
5 MJ2 Pinouts in Full and Half Duplex Modes



NOTES

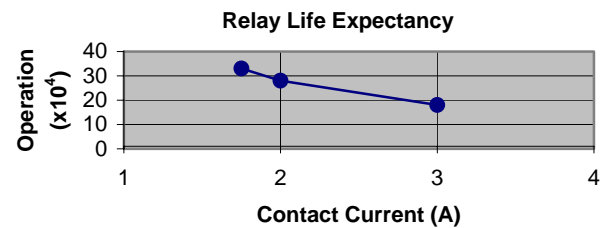
6 Filter

Filter Constant sets the level of digital filtering according to the following chart.



Digital Filtering. The illustration above demonstrates the effect of digital filtering (set with Filter Constant) on module response to a temperature change.

7 Derating



9 Safety

When found on the product, the following symbols specify:



Warning: Electrical Shock Hazard.



Warning: Consult user documentation.

8 I/O Register Map

Registers	Description
%I1 to %I24	Digital Inputs
%I32	Output Fault
%I25 to %I31	Reserved
%Q1 to %Q16	Digital outputs
%Q17	Clear HSC1 accumulator to 0
%Q18	Totalizer: Clear HSC2 Quadrature 1-2: Accumulator 1 Reset to max – 1
%Q19	Clear HSC3 Accumulator to 0
%Q20	Totalizer: Clear HSC4 Quadrature 3-4: Accumulator 3 Reset to max – 1
%Q21 to %Q32	Reserved
%AI1 to %AI4	Analog inputs
%AI5, %AI6	HSC1 Accumulator
%AI7, %AI8	HSC2 Accumulator
%AI9, %AI10	HSC3 Accumulator
%AI11, %AI12	HSC4 Accumulator
%AQ1, %AQ2	PWM1 Duty Cycle
%AQ3, %AQ4	PWM2 Duty Cycle
%AQ5, %AQ6	PWM Prescale
%AQ7, %AQ8	PWM Period
%AQ9 to %AQ14	Analog outputs
Note: Not all XLe units contain the I/O listed in this table.	

WARNING: To avoid the risk of electric shock or burns, always connect the safety (or earth) ground before making any other connections.

WARNING: To reduce the risk of fire, electrical shock, or physical injury it is strongly recommended to fuse the voltage measurement inputs. Be sure to locate fuses as close to the source as possible.

WARNING: Replace fuse with the same type and rating to provide protection against risk of fire and shock hazards.

WARNING: In the event of repeated failure, do not replace the fuse again as a repeated failure indicates a defective condition that will not clear by replacing the fuse.

WARNING: Only qualified electrical personnel familiar with the construction and operation of this equipment and the hazards involved should install, adjust, operate, or service this equipment. Read and understand this manual and other applicable manuals in their entirety before proceeding. Failure to observe this precaution could result in severe bodily injury or loss of life.

- All applicable codes and standards need to be followed in the installation of this product.
- Adhere to the following safety precautions whenever any type of connection is made to the module:
 - Connect the safety (earth) ground on the power connector first before making any other connections.
 - When connecting to electric circuits or pulse-initiating equipment, open their related breakers.
 - Do not make connections to live power lines.
 - Make connections to the module first; then connect to the circuit to be monitored.
 - Route power wires in a safe manner in accordance with good practice and local codes.
 - Wear proper personal protective equipment including safety glasses and insulated gloves when making connections to power circuits.
 - Ensure hands, shoes, and floor are dry before making any connection to a power line.
 - Make sure the unit is turned OFF before making connection to terminals.
 - Make sure all circuits are de-energized before making connections.
 - Before each use, inspect all cables for breaks or cracks in the insulation. Replace immediately if defective.
- Use Copper Conductors in Field Wiring Only, 60/75° C

10 Technical Support

For assistance and manual updates, contact Technical Support at the following locations:

North America:
(317) 916-4274
www.heapg.com
email: techspt@heapg.com

Europe:
(+) 353-21-4321-266
www.horner-apg.com
email: techsupport@homeril.ie

Information in this document is subject to change without notice. This document is the property of Horner APG and shall not be modified as to content unless specifically authorized.

"WARNING: EXPOSURE TO SOME CHEMICALS MAY DEGRADE THE SEALING PROPERTIES OF MATERIALS USED IN THE Tyco relay PCJ

Cover / case & base: Mitsubishi engineering Plastics Corp.
5010GN6-30 or 5010GN6-30 M8 (PBT)
Sealing Material: Kishimoto 4616-50K (I part epoxy resin)

It is recommended to periodically inspect the relay for any degradation of properties and replace if degradation is found



XLE OCS Model:
HE-XE103 / HE-XE220C113 / HE-XE220C013
12 Digital DC Inputs / 12 Digital Outputs
2 Analog Inputs (Medium Resolution)

XLE OCS Model:
HE-XE104 / HE-XE220C114 / HE-XE220C014
24 Digital DC Inputs / 16 Digital Outputs
2 Analog Inputs (Medium Resolution)

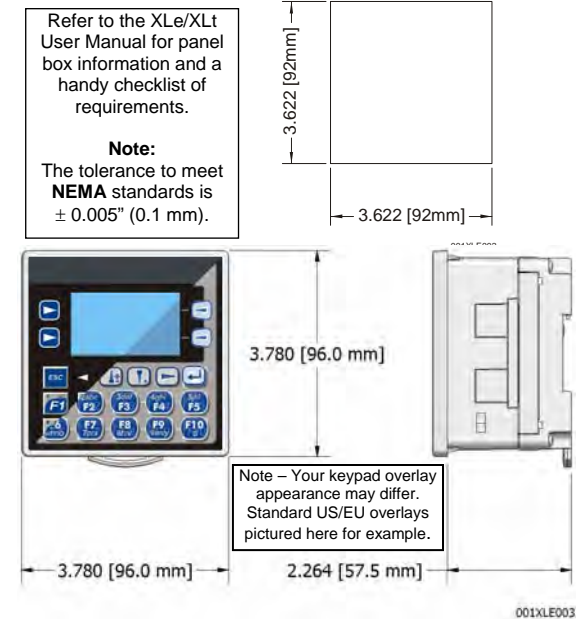
1 Specifications

Specifications						
Digital DC Inputs	XLE103		XLE104	Digital DC Outputs	XLE103	XLE104
Inputs per Module	12 including 4 configurable HSC inputs		24 including 4 configurable HSC inputs	Outputs per Module	12 including 2 configurable PWM outputs	16 including 2 configurable PWM outputs
Commons per Module	1			Commons per Module	1	
Input Voltage Range	12 VDC / 24 VDC			Output Type	Sourcing / 10 K Pull-Down	
Absolute Max. Voltage	35 VDC Max.			Absolute Max. Voltage	28 VDC Max.	
Input Impedance	10 kΩ			Output Protection	Short Circuit	
Input Current	Positive Logic	Negative Logic		Max. Output Current per point	0.5 A	
Upper Threshold	0.8 mA	-1.6 mA		Max. Total Current	4 A Continuous	
Lower Threshold	0.3 mA	-2.1 mA		Max. Output Supply Voltage	30 VDC	
Max Upper Threshold	8 VDC			Minimum Output Supply Voltage	10 VDC	
Min Lower Threshold	3 VDC			Max. Voltage Drop at Rated Current	0.25 VDC	
OFF to ON Response	1 ms			Max. Inrush Current	650 mA per channel	
ON to OFF Response	1 ms			Min. Load	None	
HSC Max. Switching Rate	10 kHz Totalizer/Pulse,Edges 5 kHz Frequency/Pulse,Width 2.5 kHz Quadrature			OFF to ON Response	1 ms	
Analog Inputs, Medium Resolution	XLE103	XLE104		ON to OFF Response	1 ms	
Number of Channels	2	2		Output Characteristics	Current Sourcing (Pos logic)	
Input Ranges	0 - 10 VDC 0 – 20 mA 4 – 20 mA -0.5 V to +12V Current Mode: 100 Ω Voltage Mode: 500 k Ω			General Specifications		
Safe input voltage range				Required Power (Steady State)	130 mA @ 24 VDC	
Input Impedance (Clamped @ -0.5 VDC to 12 VDC)				Required Power (Inrush)	30 A for 1 ms @ 24 VDC	
Nominal Resolution	10 Bits 32,000 counts 35 mA			Primary Power Range	10 – 30 VDC	
%AI full scale				Relative Humidity	5 to 95% Non-condensing	
Max. Over-Current	All channels converted once per ladder scan			Operating Temperature	0°C to +50°C	
Conversion Speed				Terminal Type	Screw Type,5 mm Removable	
Max. Error at 25°C (excluding zero)	4-20 mA 1.00% 0-20 mA 1.00% 0-10 VDC 0.50%			CE	See Compliance Table at http://www.heapg.com/Pages/TechSupport/ProductCert.html	
Additional error for temperatures other than 25°C				UL		
Filtering	160 Hz hash (noise) filter 1-128 scan digital running average filter			Weight	12.5 oz. (354.36 g)	
				Clock Accuracy	+/- One Minute/Month at 20C	

Note: Highest usable frequency for PWM output is 65 KHz

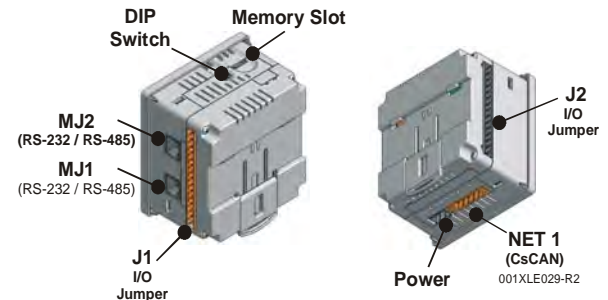
2 Panel Cut-Out and Dimensions

Note: Max. panel thickness: 5 mm.



3 Ports / Connectors / Cables

Note: The case of the XLe is black, but for clarity, it is shown in a lighter gray color.

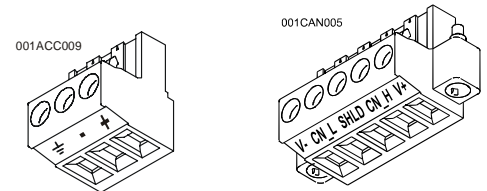


To Remove Back Cover:
Unscrew 4 screws located on the back of the unit and remove back cover.

CAUTION: Do not over tighten screws when replacing the back cover.

I/O Jumpers (Not Shown): I/O Jumpers (JP) are located internally. To access, remove back cover of unit.

Wiring Connectors (J1 - J4), I/O Jumpers (JP1-3), and External Jumpers (RS-485) are described in the **Wiring and Jumpers** section of this document.



Power Connector

CAN Connector

Power Up:
Connect to Earth Ground.
Apply 10 - 30 VDC.
Screen lights up.
Torque rating 4.5 - 7 Lb-In
(0.50 - 0.78 N-m)

Use the CAN Connector when using CsCAN network.

Torque rating 4.5 - 7 Lb-In
(0.50 - 0.78 N-m)

ECN P40_XLe-t_Data_Sheets

Section 3 continued

Memory Slot:

Uses **Removable Memory** for data logging, screen captures, program loading and recipes.

Horner Part No.: HE-MC1

Serial Communications:

MJ1: (RS-232 / RS-485) Use for Cscape programming and Application-Defined Communications.

MJ2: (RS-232 / RS-485) Use for Application-Defined Communications.

Pin	MJ1 Pins	MJ2 Pins
8	TXD	OUT
7	RXD	IN
6	0 V	Ground
5*	+5 60mA	OUT
4	RTS	OUT
3	CTS	IN
2	RX- / TX-	IN / OUT
1	RX+ / TX+	IN / OUT

* +5Vdc 60mA Max on XLe Rev E and later

4 Wiring and Jumpers

- Wire according to the type of inputs / outputs used and select the appropriate jumper option. Use Copper Conductors in Field Wiring Only, 60/75° C

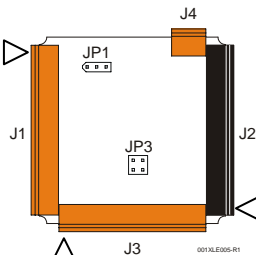
Wiring Specifications

Location of I/O jumpers (JP) and wiring connectors (J1 – J4).

•For I/O wiring (discrete), use the following wire type or equivalent: Belden 9918, 18 AWG (0.8 mm²) or larger.

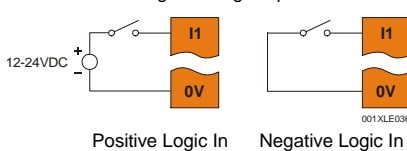
•For shielded Analog I/O wiring, use the following wire type or equivalent: Belden 8441, 18 AWG (0.8 mm²) or larger.

•For CAN wiring, use the following wire type or equivalent: Belden 3084, 24 AWG (0.2 mm²) or larger.



Positive Logic vs. Negative Logic Wiring

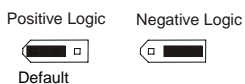
The XLe can be wired for Positive Logic inputs or Negative Logic inputs.



4.1 I/O Jumpers Settings (JP1 – JP3)

Note: The Cscape Module Setup configuration must match the selected I/O (JP) jumper settings.

JP1 Digital DC Inputs



JP3 CURRENT OR VOLTAGE INPUTS



Note: When using JP3 (A1-A2), each channel can be independently configured.

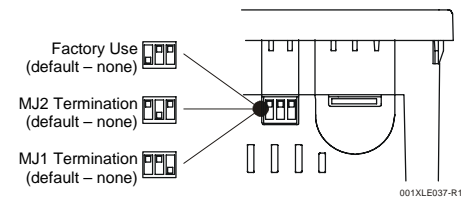
4.2 External DIP Switch Settings (or Jumpers Settings)

Some XLes have jumpers to set RS-485 port termination, though most use DIP Switches.

The External Jumpers or DIP Switches are used for termination of the RS-485 ports. The XLe is shipped un-terminated.

To terminate, select one of the jumpers shipped with the product and insert it based upon the option that is desired or, **select the switch** (as shown in the illustration) and configure based upon the option that is desired.

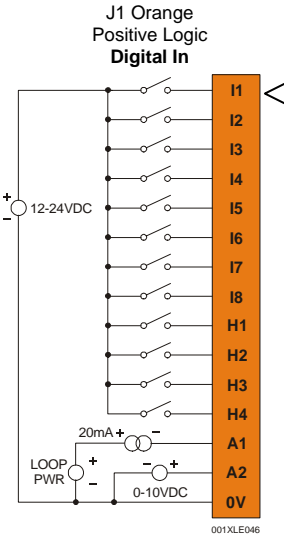
As seen when looking at the top of the XLe unit:



4.3 Wiring Examples

Note: The wiring examples show **Positive Logic** input wiring.

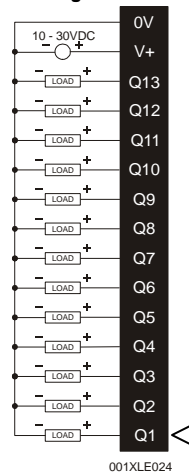
J1 Orange	XE103 / XE104 Name
I1	IN1
I2	IN2
I3	IN3
I4	IN4
I5	IN5
I6	IN6
I7	IN7
I8	IN8
H1	HSC1 / IN9
H2	HSC2 / IN10
H3	HSC3 / IN11
H4	HSC4 / IN12
A1	Analog IN1
A2	Analog IN2
0V	Ground



Note: Loop Power requirements are determined by the transmitter specification.

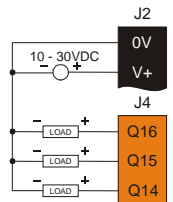
J2 Black	XE103	XE104
0V	Ground	
V+	V+ *	
NC	No Connect	OUT13
Q12	OUT12	
Q11	OUT11	
Q10	OUT10	
Q9	OUT9	
Q8	OUT8	
Q7	OUT7	
Q6	OUT6	
Q5	OUT5	
Q4	OUT4	
Q3	OUT3	
Q2	OUT2 / PWM2	
Q1	OUT1 / PWM1	
	V+* Supply for Sourcing Outputs	

J2 Black Positive Logic Digital Out



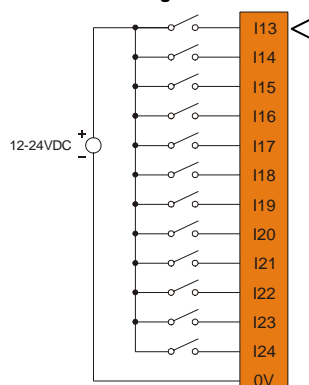
XE104 J4 Orange Positive Logic Digital Out

J4 Orange	XE104
Q16	OUT16
Q15	OUT15
Q14	OUT14



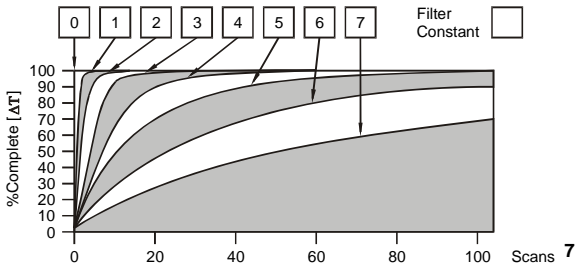
J3 Orange	XE104
I13	IN13
I14	IN14
I15	IN15
I16	IN16
I17	IN17
I18	IN18
I19	IN19
I20	IN20
I21	IN21
I22	IN22
I23	IN23
I24	IN24
0V	Ground

J3 Orange Positive Logic Digital In



5 Filter

Filter Constant sets the level of digital filtering according to the following chart.



Digital Filtering. The illustration above demonstrates the effect of digital filtering (set with Filter Constant) on module response to a temperature change.

6 I/O Register Map

Registers	Description
%I1 to %I24	Digital Inputs
%I32	Output Fault
%I25 to %I31	Reserved
%Q1 to %Q16	Digital outputs
%Q17	Clear HSC1 accumulator to 0
%Q18	Totalizer: Clear HSC2 Quadrature 1-2: Accumulator 1 Reset to max – 1
%Q19	Clear HSC3 Accumulator to 0
%Q20	Totalizer: Clear HSC4 Quadrature 3-4: Accumulator 3 Reset to max – 1
%Q21 to %Q32	Reserved
%AI1 to %AI4	Analog inputs
%AI5, %AI6	HSC1 Accumulator
%AI7, %AI8	HSC2 Accumulator
%AI9, %AI10	HSC3 Accumulator
%AI11, %AI12	HSC4 Accumulator
%AQ1, %AQ2	PWM1 Duty Cycle
%AQ3, %AQ4	PWM2 Duty Cycle
%AQ5, %AQ6	PWM Prescale
%AQ7, %AQ8	PWM Period
%AQ9 to %AQ14	Analog outputs

Note: Not all XLe units contain the I/O listed in this table.

Registers	PWM	HSC	Stepper
%AQ1	PWM1 Duty Cycle (32 bit)	HSC1 Preset Value	Start Frequency
%AQ2			Run Frequency
%AQ3	PWM2 Duty Cycle (32 bit)	HSC2 Preset Value	Accel Count (32 bit)
%AQ4			
%AQ5	PWM Prescale (32 bit)		Run Count (32 bit)
%AQ6			
%AQ7	PWM Period (32 bit)		Decel Count (32 bit)
%AQ8			
%Q1			Run
%I30			Ready/Done
%I31			Error

MJ2 Pinouts in Full and Half Duplex Modes

Pin	MJ2 Pins	
	Signal	Direction
8	TXD	OUT
7	RXD	IN
6	0 V	Ground
5*	+5 60mA	OUT
4	TX-	OUT
3	TX+	OUT
2	RX-	IN
1	RX+	IN

* +5 on XLe Rev E and later

Full Duplex Mode

Pin	MJ2 Pins	
	Signal	Direction
8	TXD	OUT
7	RXD	IN
6	0 V	Ground
5*	+5 60mA	OUT
4	TX-	OUT
3	TX+	OUT
2	TX-/RX-	IN/OUT
1	TX+/RX+	IN/OUT

* +5 on XLe Rev E and later

Half Duplex Mode

8 Safety

When found on the product, the following symbols specify:



Warning: Electrical Shock Hazard.



Warning: Consult user documentation.

WARNING: To avoid the risk of electric shock or burns, always connect the safety (or earth) ground before making any other connections.

WARNING: To reduce the risk of fire, electrical shock, or physical injury it is strongly recommended to fuse the voltage measurement inputs. Be sure to locate fuses as close to the source as possible.

WARNING: Replace fuse with the same type and rating to provide protection against risk of fire and shock hazards.

WARNING: In the event of repeated failure, do not replace the fuse again as a repeated failure indicates a defective condition that will not clear by replacing the fuse.

WARNING: Only qualified electrical personnel familiar with the construction and operation of this equipment and the hazards involved should install, adjust, operate, or service this equipment. Read and understand this manual and other applicable manuals in their entirety before proceeding. Failure to observe this precaution could result in severe bodily injury or loss of life.

- All applicable codes and standards need to be followed in the installation of this product.
- Adhere to the following safety precautions whenever any type of connection is made to the module:
 - Connect the safety (earth) ground on the power connector first before making any other connections.
 - When connecting to electric circuits or pulse-initiating equipment, open their related breakers.
 - Do not make connections to live power lines.
 - Make connections to the module first; then connect to the circuit to be monitored.
 - Route power wires in a safe manner in accordance with good practice and local codes.
 - Wear proper personal protective equipment including safety glasses and insulated gloves when making connections to power circuits.
 - Ensure hands, shoes, and floor are dry before making any connection to a power line.
 - Make sure the unit is turned OFF before making connection to terminals.
 - Make sure all circuits are de-energized before making connections.
 - Before each use, inspect all cables for breaks or cracks in the insulation. Replace immediately if defective.
- Use Copper Conductors in Field Wiring Only, 60/75° C

9 Technical Support

For assistance and manual updates, contact Technical Support at the following locations:

North America:

(317) 916-4274

www.heapg.com

email: techsppt@heapg.com

Europe:

(+) 353-21-4321-266

www.horner-apg.com

email: techsupport@hornerir.ie

Information in this document is subject to change without notice. This document is the property of Horner APG and shall not be modified as to content unless specifically authorized.



XLE OCS Model:
HE-XE105 / HE-XE220C115 / HE-XE220C015
12 Digital DC Inputs / 12 Digital DC Outputs
2 Analog Inputs (High Resolution) / 2 Analog Outputs

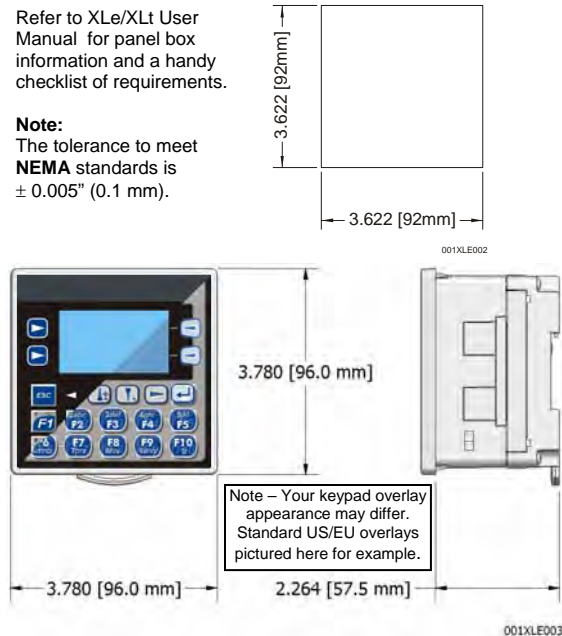
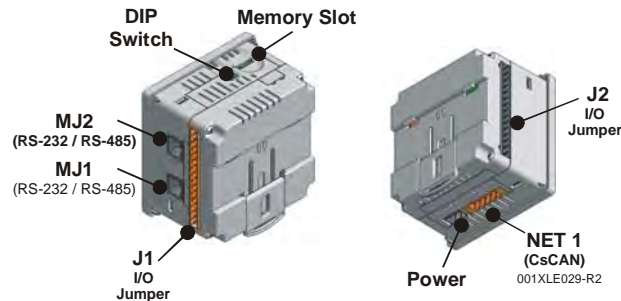
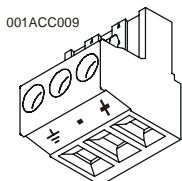
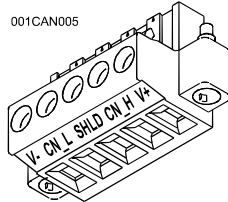
Digital DC Inputs			Digital DC Outputs	
Inputs per Module	12 including 4 configurable HSC inputs		Outputs per Module	12 including 2 configurable PWM outputs
Commons per Module	1		Commons per Module	1
Input Voltage Range	12 VDC / 24 VDC		Output Type	Sourcing / 10 K Pull-Down
Absolute Max. Voltage	35 VDC Max.		Absolute Max. Voltage	28 VDC Max.
Input Impedance	10 k Ω		Output Protection	Short Circuit
Input Current	Positive Logic	Negative Logic	Max. Output Current per point	0.5 A
Upper Threshold	0.8 mA	-1.6 mA	Max. Total Current	4 A Continuous
Lower Threshold	0.3 mA	-2.1 mA	Max. Output Supply Voltage	30 VDC
Max Upper Threshold	8 VDC		Minimum Output Supply Voltage	10 VDC
Min Lower Threshold	3 VDC		Max. Voltage Drop at Rated Current	0.25 VDC
OFF to ON Response	1 ms		Max. Inrush Current	650 mA per channel
ON to OFF Response	1 ms		Min. Load	None
HSC Max. Switching Rate	10 kHz Totalizer/Pulse, Edges 5 kHz Frequency/Pulse, Width 2.5 kHz Quadrature		OFF to ON Response	1 ms
			ON to OFF Response	1 ms
			Output Characteristics	Current Sourcing (Positive Logic)
Analog Inputs, High Resolution				
Number of Channels	2		Thermocouple	Temperature Range
Input Ranges (Selectable)	0 - 10 VDC 0 - 20 mA 4 - 20 mA 100mV PT100 RTD, and J, K, N, T, E, R, S, B Thermocouples		B / R / S	2912°F to 32.0°F (1600°C to 0°C)
			E	1652°F to -328°F (900°C to -200°C)
			T	752.0°F to -400.0°F (400°C to -240°C)
			J	1382.0°F to -346.0°F (750°C to -210°C)
Safe input voltage range	10 VDC: -0.5 V to +15 V 20 mA: -0.5 V to +6 V RTD / T/C: \pm 24 VDC		K / N	2498.0°F to -400°F (1370°C to -240°C)
			Thermocouple Common Mode Range	\pm 10V
Nominal Resolution	10V, 20mA, 100mV: 14 Bits RTD, Thermocouple: 16 Bits		Converter Type	Delta Sigma
Input Impedance (Clamped @ -0.5 VDC to 12 VDC)	Current Mode: 100 Ω , 35mA Max. Continuous Voltage Mode: 500 k Ω , 35mA Max. Continuous		Max. Error at 25°C (*excluding zero)	*4-20 mA \pm 0.10%* *0-20 mA \pm 0.10%* *0-10 VDC \pm 0.10%* RTD (PT100) \pm 1.0 °C 0-100 mV \pm 0.05%
			Max Thermocouple Error (After Warm Up Time of One Hour)	\pm 0.2% (\pm 0.3% below -100°C)
%AI full scale	10 V, 20 mA, 100 mV: 32,000 counts full scale. RTD / T/C: 20 counts / °C		Conversion Speed, Both Channels Converted	10V, 20mA, 100mV: 30 Times/Second RTD, Thermocouple: 7.5 Times/Second
Max. Over-Current	35 mA		Conversion Time per Channel	10V, 20mA, 100mV: 16.7mS RTD, Thermocouple: 66.7mS
Open Thermocouple Detect Current	50 nA		RTD Excitation Current	250 μ A
Analog Outputs		General Specifications		
Number of Channels	2	Required Power (Steady State)	130 mA @ 24 VDC	
Output Ranges	0-10 VDC, 0-20 mA	Required Power (Inrush)	30 A for 1 ms @ 24 VDC	
Nominal Resolution	12 Bits	Primary Power Range	10 - 30 VDC	
Update rate	Once per PLC scan	Operating Temperature	0° to 50° Celsius	
Minimum 10 V load	1 k Ω	Storage Temperature	14 to 140°F (-10 to 60°C)	
Maximum 20 mA load	500 Ω	Relative Humidity	5 to 95% Non-condensing	
Analog Outputs; Output Points Required	2	Filtering	15Hz hash (noise) filter 1-128 scan digital running average filter	
Maximum Error at 25°C (excluding zero)	0.1%	Terminal Type	Screw Type, 5 mm Removable	
		Weight	12.5 oz. (354.36)	
Additional error for temperatures other than 25°C	0.01% / °C	CE	See Compliance Table at http://www.heapg.com/Pages/TechSupport/ProductCert.html	
		UL		
		Clock Accuracy	\pm 1 Minute/Month at 20C	

Note: Highest usable frequency for PWM output is 65 KHz

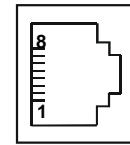
2 Panel Cut-Out and Dimensions

Note: Max. panel thickness: 5 mm.

Refer to XLe/XLt User Manual for panel box information and a handy checklist of requirements.

Note:
The tolerance to meet NEMA standards is $\pm 0.005"$ (0.1 mm).**3 Ports / Connectors / Cables****Note:** The case of the XLe is black, but for clarity, it is shown in a lighter gray color.**To Remove Back Cover:**
Unscrew 4 screws located on the back of the unit.
Remove Cover.**CAUTION:**
Do not over tighten screws when replacing the back cover.**I/O Jumpers (Not Shown):** I/O Jumpers (JP) are located internally. To access, remove back cover of unit.**Wiring Connectors (J1 – J3), I/O Jumpers (JP1 – JP4), and External Jumpers (RS-485)** are described in the **Wiring and Jumpers** section of this document.**Power Connector****Power Up:**
Connect to Earth Ground.
Apply 10 - 30 VDC.
Screen lights up.Torque rating 4.5 – 7 Lb-In
(0.50 – 0.78 N-m)**CAN Connector**

Use the CAN Connector when using CsCAN network.

Torque Rating 4.5 – 7 Lb-In
(0.50 – 0.78 N-m)**Serial Communications:**
MJ1 and MJ2
(RS-232 / RS-485)

Pin	MJ1 Pins		MJ2 Pins	
	Signal	Direction	Signal	Direction
8	TXD	OUT	TXD	OUT
7	RXD	IN	RXD	IN
6	0 V	Ground	0 V	Ground
5*	+5 60mA	OUT	+5 60mA	OUT
4	RTS	OUT	TX-	OUT
3	CTS	IN	TX+	OUT
2	RX- / TX-	IN / OUT	TX-/RX-	IN
1	RX+ / TX+	IN / OUT	TX+/RX+	IN

* +5Vdc 60mA Max on XLe Rev E and later

4 Wiring and Jumpers

- Wire according to the type of inputs / outputs used and select the appropriate jumper option. Use Copper Conductors in Field Wiring Only, 60/75° C

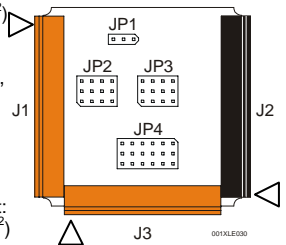
Wiring Specifications

- For I/O wiring (discrete), use the following wire type or equivalent: Belden 9918, 18 AWG (0.8 mm²) or larger.

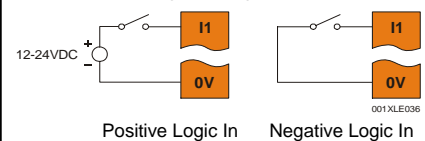
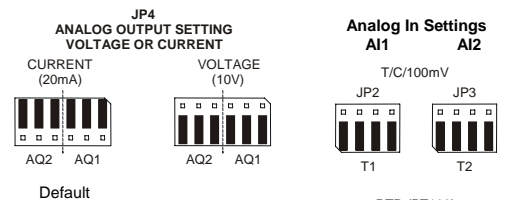
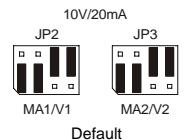
- For shielded Analog I/O wiring, use the following wire type or equivalent: Belden 8441, 18 AWG (0.8 mm²) or larger.

- For CAN wiring, use the following wire type or equivalent: Belden 3084, 24 AWG (0.2 mm²) or larger.

Location of I/O jumpers (JP) and wiring connectors (J1 – J3).

**Positive Logic vs. Negative Logic Wiring**

The XLe can be wired for Positive Logic inputs or Negative Logic inputs.

**4.1 I/O Jumpers Settings (JP1 – JP4)****Note:** The Cscape Module Setup configuration must match the selected I/O (JP) jumper settings.**Note:** When using JP4 (output) or JP2 / JP3 (inputs), each channel can be independently configured. For example, JP2 can be configured for 10 V and JP3 can be configured as an RTD.**JP1 Digital DC Inputs**

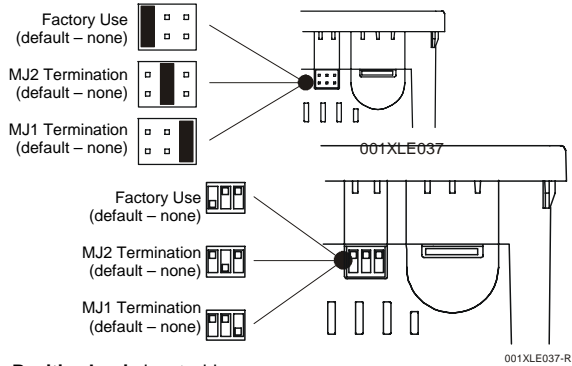
4.2 External DIP Switch Settings (or Jumpers Settings)

Some XLEs have jumpers to set RS-485 port termination, though most use DIP Switches.

The External Jumpers or DIP Switches are used for termination of the RS-485 ports. The XLE is shipped un-terminated.

To terminate, select one of the jumpers shipped with the product and insert it based upon the option that is desired or, select the switch and configure based upon the option that is desired.

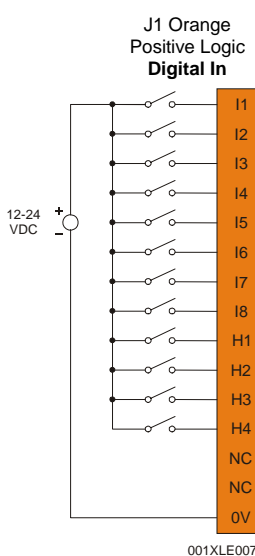
As seen when looking at the top of the XLE unit: Refer to Section 3 for the location of the External Jumpers.



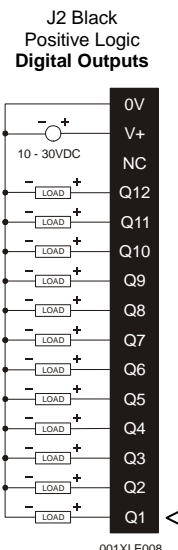
4.3 Wiring Examples

Note: The wiring examples show **Positive Logic** input wiring.

J1 Orange	Name
I1	IN1
I2	IN2
I3	IN3
I4	IN4
I5	IN5
I6	IN6
I7	IN7
I8	IN8
H1	HSC1 / IN9
H2	HSC2 / IN10
H3	HSC3 / IN11
H4	HSC4 / IN12
NC	No Connect
NC	No Connect
0V	Ground

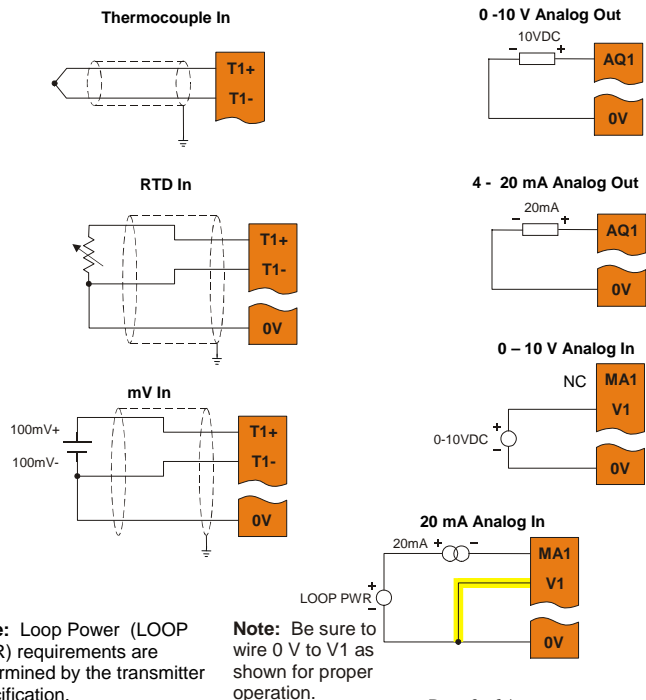


J2 Black	Name
0V	Ground
V+*	V+*
NC	No Connect
Q12	OUT12
Q11	OUT11
Q10	OUT10
Q9	OUT9
Q8	OUT8
Q7	OUT7
Q6	OUT6
Q5	OUT5
Q4	OUT4
Q3	OUT3
Q2	OUT2 / PWM2
Q1	OUT1 / PWM1
V+* Supply for Sourcing Outputs	



J3 Orange	Name
T1+	T/C / RTD IN1+ / 100 mV+
T1-	T/C / RTD IN1- / 100 mV-
T2+	T/C / RTD IN2+ / 100 mV+
T2-	T/C / RTD IN2- / 100 mV-
AQ1	10 V / 20 mA OUT1
AQ2	0 V / 20 mA OUT2
0V	Ground
MA1	20 mA IN1
V1	10 V IN1
0V	Ground
MA2	20 mA IN2
V2	10 V IN2
0V	Ground

Note: A total of 2 Analog Inputs can be used (T/C, RTD, mV, mA, and V).



Note: Loop Power (LOOP PWR) requirements are determined by the transmitter specification.

Note: Be sure to wire 0 V to V1 as shown for proper operation.

5 I/O Register Map

Registers	Description
%I1 to %I24	Digital Inputs
%I32	Output Fault
%I25 to %I31	Reserved
%Q1 to %Q16	Digital outputs
%Q17	Clear HSC1 accumulator to 0
%Q18	Totalizer: Clear HSC2 Quadrature 1-2: Accumulator 1 Reset to max - 1
%Q19	Clear HSC3 Accumulator to 0
%Q20	Totalizer: Clear HSC4 Quadrature 3-4: Accumulator 3 Reset to max - 1
%Q21 to %Q32	Reserved
%AI1 to %AI4	Analog inputs
%AI5, %AI6	HSC1 Accumulator
%AI7, %AI8	HSC2 Accumulator
%AI9, %AI10	HSC3 Accumulator
%AI11, %AI12	HSC4 Accumulator
%AQ1, %AQ2	PWM1 Duty Cycle
%AQ3, %AQ4	PWM2 Duty Cycle
%AQ5, %AQ6	PWM Prescale
%AQ7, %AQ8	PWM Period
%AQ9 to %AQ14	Analog outputs

Note: Not all XLE units contain the I/O listed in this table.

Registers	PWM	HSC	Stepper
%AQ1	PWM1 Duty Cycle (32 bit)	HSC1 Preset Value	Start Frequency
%AQ2	PWM1 Duty Cycle (32 bit)	HSC1 Preset Value	Run Frequency
%AQ3	PWM2 Duty Cycle (32 bit)	HSC2 Preset Value	Accel Count (32 bit)
%AQ4	PWM2 Duty Cycle (32 bit)	HSC2 Preset Value	Accel Count (32 bit)
%AQ5	PWM Prescale (32 bit)		Run Count (32 bit)
%AQ6	PWM Prescale (32 bit)		Run Count (32 bit)
%AQ7	PWM Period (32 bit)		Decel Count (32 bit)
%AQ8	PWM Period (32 bit)		Decel Count (32 bit)
%Q1			Run
%I30			Ready/Done
%I31			Error

6 MJ2 Pinouts in Full and Half Duplex Modes

Pin	MJ2 Pins	Signal	Direction
8	TXD	OUT	
7	RXD	IN	
6	0 V	Ground	
5*	+5 60mA	OUT	
4	TX-	OUT	
3	TX+	OUT	
2	RX-	IN	
1	RX+	IN	

Full Duplex

* +5Vdc 60mA Max on XLE Rev E and later

Pin	MJ2 Pins	Signal	Direction
8	TXD	OUT	
7	RXD	IN	
6	0 V	Ground	
5*	+5 60mA	OUT	
4	TX-	OUT	
3	TX+	OUT	
2	TX-/RX-	IN/OUT	
1	TX+/RX+	IN/OUT	

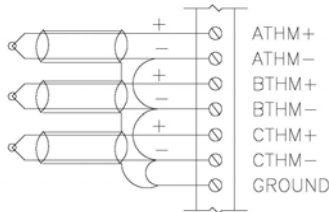
Half Duplex

7 Digital Filtering for Analog Inputs

The digital filter is updated once per conversion. It is an "IIR" running average filter that emulates a simple RC filter. The equivalent time constant is determined by the Filter Constant and the sum of the conversion times for the two channels. The Filter Constant determines the weight given to the most recent conversion. The following table lists the equivalent time constant for the three possible total conversion times, which are dependent upon the two input mode selections. This filter delay is in addition to the PLC scan delay.

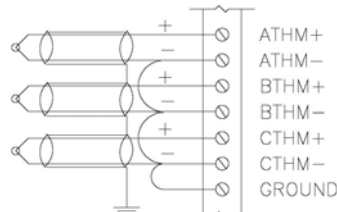
Equivalent RC Time Constant in Seconds (Nominal time to reach 63% of final value.)			
Total Conversion Time in Seconds			
Filter Constant	0.03	0.09	0.13
0*	0.03*	0.09*	0.13*
1	0.07	0.18	0.27
2	0.13	0.35	0.53
3	0.27	0.71	1.07
4	0.53	1.41	2.13
5	1.07	2.83	4.27
6	2.14	5.65	8.54
7	4.28	11.30	17.08

* No filter delay, reading is unfiltered conversion value

8 Thermocouple Grounding Schemes

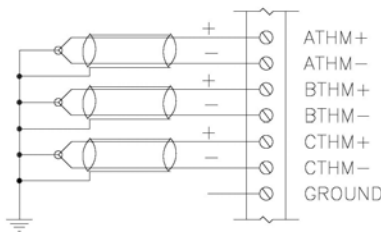
Ungrounded Thermocouples

Alternate Shield Connection for Ungrounded Thermocouples.



Ungrounded Thermocouples

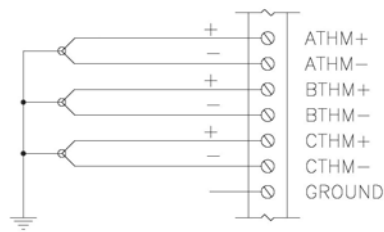
Preferred Shield Connection for Ungrounded Thermocouples.



Grounded Thermocouples

Field Ground Potential Less Than Seven Volts AC

Typical Shield Connection for Grounded Thermocouples



Grounded Thermocouples

Field Ground Potential Less Than Seven Volts AC

Shields Connected at One End Only May be Used to Reduce Noise

Grounded Thermocouples May Use the Ungrounded Thermocouple Shield Connections if the Shield is not Grounded at the Field End

Note: The examples for thermocouple grounding schemes above are generic illustrations. The XE105 has two thermocouple inputs.

9 Safety

When found on the product, the following symbols specify:



Warning: Electrical Shock Hazard.



Warning: Consult user documentation.

WARNING: To avoid the risk of electric shock or burns, always connect the safety (or earth) ground before making any other connections.

WARNING: To reduce the risk of fire, electrical shock, or physical injury it is strongly recommended to fuse the voltage measurement inputs. Be sure to locate fuses as close to the source as possible.

WARNING: Replace fuse with the same type and rating to provide protection against risk of fire and shock hazards.

WARNING: In the event of repeated failure, do not replace the fuse again as a repeated failure indicates a defective condition that will not clear by replacing the fuse.

WARNING: Only qualified electrical personnel familiar with the construction and operation of this equipment and the hazards involved should install, adjust, operate, or service this equipment. Read and understand this manual and other applicable manuals in their entirety before proceeding. Failure to observe this precaution could result in severe bodily injury or loss of life.

• All applicable codes and standards need to be followed in the installation of this product.

• Adhere to the following safety precautions whenever any type of connection is made to the module:

• Connect the safety (earth) ground on the power connector first before making any other connections.

• When connecting to electric circuits or pulse-initiating equipment, open their related breakers.

• Do not make connections to live power lines.

• Make connections to the module first; then connect to the circuit to be monitored.

• Route power wires in a safe manner in accordance with good practice and local codes.

• Wear proper personal protective equipment including safety glasses and insulated gloves when making connections to power circuits.

• Ensure hands, shoes, and floor are dry before making any connection to a power line.

• Make sure the unit is turned OFF before making connection to terminals.

• Make sure all circuits are de-energized before making connections.

• Before each use, inspect all cables for breaks or cracks in the insulation. Replace immediately if defective.

• Use Copper Conductors in Field Wiring Only, 60/75° C

10 Technical Support

For assistance and manual updates, contact Technical Support at the following locations:

North America:

(317) 916-4274

www.heapg.com

email: techspt@heapg.com

Europe:

(+) 353-21-4321-266

www.horner-appg.com

email:

techsupport@hornerirl.ie

Information in this document is subject to change without notice. This document is the property of Horner APG and shall not be modified as to content unless specifically authorized.

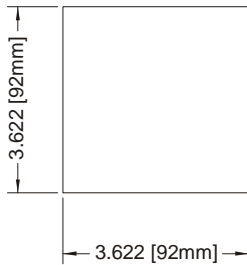
**XLt OCS Model:****HE-XT100 / HE-XT240C100 / HE-XT240C000****1 SPECIFICATIONS**

Specifications	
General Specifications	
Required Power (Steady State)	130 mA @ 24 VDC
Required Power (Inrush)	30 A for 1 ms @ 24 VDC
Primary Power Range	10 – 30 VDC
Relative Humidity	5 to 95% Non-condensing
Clock Accuracy	+/- One Minute/Month at 20C
Operating Temperature	-10°C to +60°C
Terminal Type	Screw Type, 5 mm Removable
Weight	12 oz. (340.19 g)
CE	See Compliance Table at :
UL	http://www.heapg.com/Support/compliance.htm

2 Panel Cut-Out and Dimensions

Note: Max. panel thickness: 5 mm.

Refer to the User Manual for panel box information and a handy checklist of requirements.

Note: The tolerance to meet NEMA standards is $\pm 0.005"$ (0.1 mm).

3.780 [96.0 mm]

3.780 [96.0 mm]

2.264 [57.5 mm]

Note – Your keypad overlay appearance may differ. Standard US/EU overlays pictured here for example.

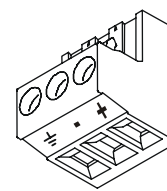
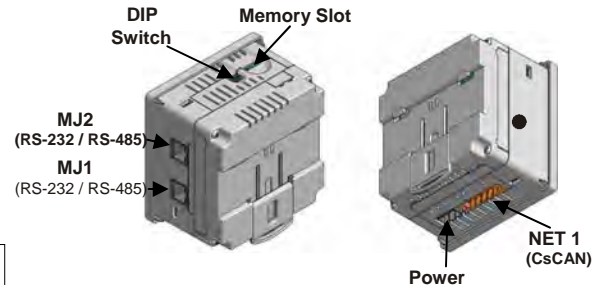
3 Ports / Connectors / Cables**Note:** The case of the XLt is black, but for clarity, it is shown in a lighter gray color.

To Remove Back Cover:
Unscrew 4 screws located on the back of the unit and remove back cover.

CAUTION: Do not over tighten screws when replacing back cover.

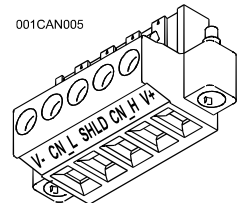
Memory Slot:
Uses **Removable Memory** for data logging, screen captures, program loading and recipes.
Horner Part No.: HE-MC1

Serial Communications:
MJ1: (RS-232 / RS-485) Use for Cscape programming and Application-Defined Communications.
MJ2: (RS-232 / RS-485) Use for Application-Defined Communications.

**Power Connector****Power Up:**

Connect to Earth Ground.
Apply 10 - 30 VDC.
Screen lights up.

Torque rating 4.5 – 7 Lb-In
(0.50 – 0.78 N-m)

**CAN Connector**

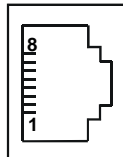
Use the CAN Connector when using CsCAN network.

Torque rating 4.5 – 7 Lb-In
(0.50 – 0.78 N-m)

Serial Communications:

MJ1: (RS-232 / RS-485) Use for Cscape programming and Application-Defined Communications.

MJ2: (RS-232 / RS-485) Use for Application-Defined Communications.



Pin	MJ1 Pins		MJ2 Pins	
	Signal	Direction	Signal	Direction
8	TXD	OUT	TXD	OUT
7	RXD	IN	RXD	IN
6	0 V	Ground	0 V	Ground
5*	+5 60mA	OUT	+5 60mA	OUT
4	RTS	OUT	TX-	OUT
3	CTS	IN	TX+	OUT
2	RX- / TX-	IN / OUT	RX-	IN
1	RX+ / TX+	IN / OUT	RX+	IN

* +5Vdc 60mA Max

4 Wiring and Jumpers

Wire according to the type of inputs / outputs used, and select the appropriate jumper option.

- Use Only Copper Conductors in Field Wiring, 60/75° C

Wiring Specifications

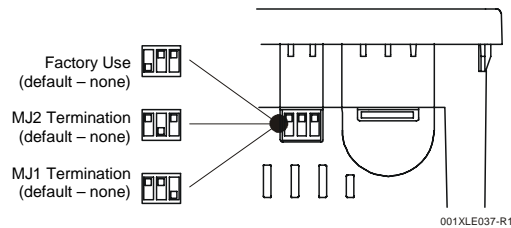
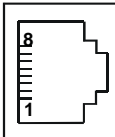
•For CAN wiring, use the following wire type or equivalent:
Belden 3084, 24 AWG (0.2 mm²) or larger.

4.1 External DIP Switch Settings

As seen when looking at the top of the XLt unit :

The DIP Switches are used for termination of the RS-485 ports. The XLt is shipped un-terminated.

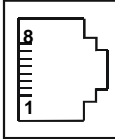
To terminate, select one of the DIP Switches and configure it based upon the option that is desired.

**5 MJ2 Pinouts in Half and Full Duplex Modes**


Pin	MJ2 Pins	
	Signal	Direction
8	TXD	OUT
7	RXD	IN
6	0 V	Ground
5*	+5 60mA	OUT
4	TX-	OUT
3	TX+	OUT
2	TX-/RX-	IN/OUT
1	TX+/RX+	IN/OUT

MJ2 Half Duplex Mode

* +5Vdc 60mA Max



Pin	MJ2 Pins	
	Signal	Direction
8	TXD	OUT
7	RXD	IN
6	0 V	Ground
5*	+5 60mA	OUT
4	TX-	OUT
3	TX+	OUT
2	RX-	IN
1	RX+	IN

MJ2 Full Duplex Mode

6 Safety

When found on the product, the following symbols specify:



Warning: Electrical Shock Hazard.



Warning: Consult user documentation.

WARNING: To avoid the risk of electric shock or burns, always connect the safety (or earth) ground before making any other connections.

WARNING: To reduce the risk of fire, electrical shock, or physical injury it is strongly recommended to fuse the voltage measurement inputs. Be sure to locate fuses as close to the source as possible.

WARNING: Replace fuse with the same type and rating to provide protection against risk of fire and shock hazards.

WARNING: In the event of repeated failure, do not replace the fuse again as a repeated failure indicates a defective condition that will not clear by replacing the fuse.

WARNING: Only qualified electrical personnel familiar with the construction and operation of this equipment and the hazards involved should install, adjust, operate, or service this equipment. Read and understand this manual and other applicable manuals in their entirety before proceeding. Failure to observe this precaution could result in severe bodily injury or loss of life.

•All applicable codes and standards need to be followed in the installation of this product.

•Adhere to the following safety precautions whenever any type of connection is made to the module:

- Connect the safety (earth) ground on the power connector first before making any other connections.
- When connecting to electric circuits or pulse-initiating equipment, open their related breakers.
- Do not make connections to live power lines.
- Make connections to the module first; then connect to the circuit to be monitored.
- Route power wires in a safe manner in accordance with good practice and local codes.
- Wear proper personal protective equipment including safety glasses and insulated gloves when making connections to power circuits.
- Ensure hands, shoes, and floor are dry before making any connection to a power line.
- Make sure the unit is turned OFF before making connection to terminals.
- Make sure all circuits are de-energized before making connections.
- Before each use, inspect all cables for breaks or cracks in the insulation. Replace immediately if defective.

6 Technical Support

For assistance and manual updates, contact Technical Support at the following locations:

North America:

(317) 916-4274

<http://www.heapg.com>

email: techsppt@heapg.com

Europe:

(+) 353-21-4321-266

<http://www.horner-apg.com>

email: techsupport@hornerirl.ie

Information in this document is subject to change without notice. This document is the property of Horner APG and shall not be modified as to content unless specifically authorized.



XLt OCS Model:
HE-XT102 / HE-XT240C112 / HE-XT240C012
12 Digital DC Inputs
4 Analog Inputs (Medium Resolution)
6 Digital Relay Outputs

1 Specifications

Specifications			
Digital DC Inputs			
Inputs per Module		12 including 4 configurable HSC inputs	
Commons per Module		1	
Input Voltage Range		12 VDC / 24 VDC	
Absolute Max. Voltage		35 VDC Max.	
Input Impedance		10 kΩ	
Input Current	Positive Logic		Negative Logic
Upper Threshold	0.8 mA		-1.6 mA
Lower Threshold	0.3 mA		-2.1 mA
Max Upper Threshold		8 VDC	
Min Lower Threshold		3 VDC	
OFF to ON Response		1 ms	
ON to OFF Response		1 ms	
HSC Max. Switching Rate		10 kHz Totalizer/Pulse, Edges 5 kHz Frequency/Pulse, Width 2.5 kHz Quadrature	
Digital Relay Outputs			
Outputs per Module		6 relay	
Commons per Module		6	
Max. Output Current per Relay		3 A at 250 VAC, resistive	
Max. Total Output Current		5 A continuous	
Max. Output Voltage		275 VAC , 30 VDC	
Max. Switched Power		1250 VA, 150 W	
Contact Isolation to XLe ground		1000 VAC	
Max. Voltage Drop at Rated Current		0.5 V	
Expected Life (See Derating section for chart.)		No load: 5,000,000 Rated load: 100,000	
Max. Switching Rate		300 CPM at no load 20 CPM at rated load	
Type		Mechanical Contact	
Response Time		One update per ladder scan plus 10 ms	
Analog Inputs, Medium Resolution			
Number of Channels		4	
Input Ranges		0 - 10 VDC 0 – 20 mA 4 – 20 mA	
Safe input voltage range		-0.5 V to +12V	
Input Impedance (Clamped @ -0.5 VDC to 12 VDC)		Current Mode: 100 Ω	Voltage Mode: 500 k Ω
Nominal Resolution		10 Bits	
%AI full scale		32,000 counts	
Max. Over-Current		35 mA	
Conversion Speed		All channels converted once per ladder scan	
Max. Error at 25°C (excluding zero) *can be made tighter (-0.25%) by adjusting the digital filter setting to 3.		4-20 mA 0-20 mA 0-10 VDC	1.00% 1.00% 1.50%*
Additional error for temperatures other than 25°C		TBD	
Filtering		160 Hz hash (noise) filter 1-128 scan digital running average filter	
General Specifications			
Required Power (Steady State)		130 mA @ 24 VDC	
Required Power (Inrush)		30 A for 1 ms @ 24 VDC	
Primary Power Range		10 – 30 VDC	
Relative Humidity		5 to 95% Non-condensing	
Clock Accuracy		+/- One Minute/Month at 20C	

Note: Highest usable frequency for PWM output is 65 KHz

General Specifications continued

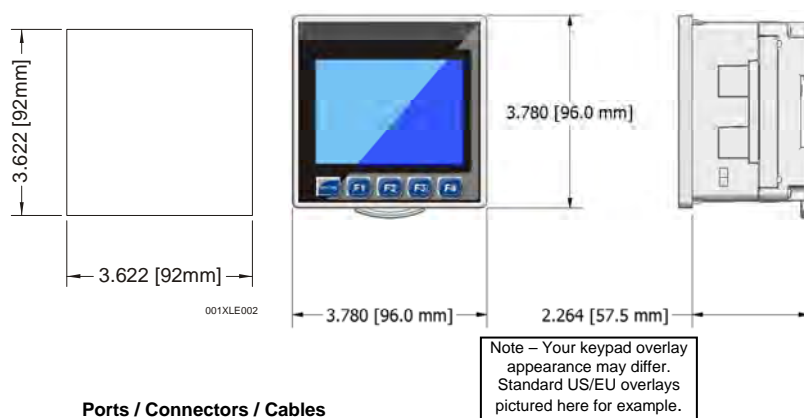
Operating Temperature	-10°C to +60°C
Terminal Type	Screw Type, 5 mm Removable
Weight	12 oz. (340.19 g)
CE	See Compliance Table at http://www.heapg.com/Pages/TechSupport/ProductCert.html
UL	

2 Panel Cut-Out and Dimensions

Note: Max. panel thickness: 5 mm.

Refer to the XLe/XLt User Manual for panel box information and a handy checklist of requirements.

Note: The tolerance to meet NEMA standards is ± 0.005 " (0.1 mm).



3 Ports / Connectors / Cables

Note: The case of the XLt is black, but for clarity, it is shown in a lighter gray color.

To Remove Back Cover:
 Unscrew 4 screws located on the back of the unit.
 Remove cover.

CAUTION: Do not over tighten screws when replacing the back cover.

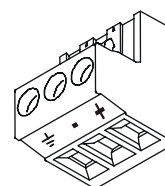
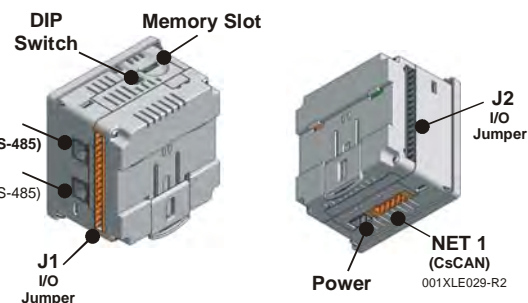
I/O Jumpers: (Not Shown):
 I/O Jumpers (JP) are located internally. To access, remove back cover of unit.

Wiring Connectors (J1 / J2):
 I/O Jumpers (JP1 / JP2), and External Jumpers (RS-485) are described in the **Wiring and Jumpers** section of this document.

Memory Slot:
 Uses **Removable Memory** for data logging, screen captures, program loading and recipes.
Hornier Part No.: HE-MC1

Serial Communications:
MJ1: (RS-232 / RS-485) Use for Cscape programming and Application-Defined Communications.

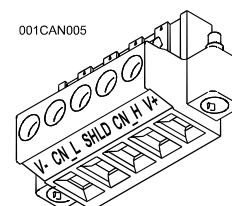
MJ2: (RS-232 / RS-485) Use for Application-Defined Communications.



Power Connector

Power Up:
 Connect to Earth Ground.
 Apply 10 - 30 VDC.
 Screen lights up.

Torque rating 4.5 - 7 Lb-In
 (0.50 - 0.78 N-m)



CAN Connector

Use the CAN Connector when using CsCAN network.

Torque Rating 4.5 - 7 Lb-In
 (0.50 - 0.78 N-m)

Serial Communications:

MJ1: (RS-232 / RS-485) Use for Cscape programming and Application-Defined Communications.

MJ2: (RS-232 / RS-485) Use for Application-Defined Communications.

Pin	MJ1 Pins		MJ2 Pins	
	Signal	Direction	Signal	Direction
8	TXD	OUT	TXD	OUT
7	RXD	IN	RXD	IN
6	0 V	Ground	0 V	Ground
5*	+5 60mA	OUT	+5 60mA	OUT
4	RTS	OUT	TX-	OUT
3	CTS	IN	TX+	OUT
2	RX- / TX-	IN / OUT	RX-	IN
1	RX+ / TX+	IN / OUT	RX+	IN

* +5Vdc 60mA Max

4 Wiring and Jumpers

Wire according to the type of inputs / outputs used, and select the appropriate jumper option.

Wiring Specifications

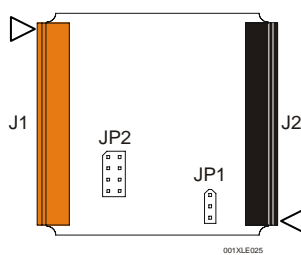
•For I/O wiring (discrete), use the following wire type or equivalent: Belden 9918, 18 AWG (0.8 mm²) or larger.

•For shielded Analog I/O wiring, use the following wire type or equivalent: Belden 8441, 18 AWG (0.8 mm²) or larger.

•For CAN wiring, use the following wire type or equivalent: Belden 3084, 24 AWG (0.2 mm²) or larger.

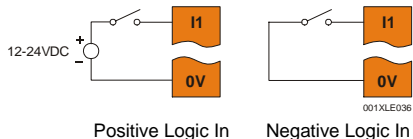
Use copper conductors in field

Location of I/O jumpers (JP) and wiring connectors (J1 and J2).



Positive Logic vs. Negative Logic Wiring

The XLt can be wired for Positive Logic inputs or Negative Logic inputs.

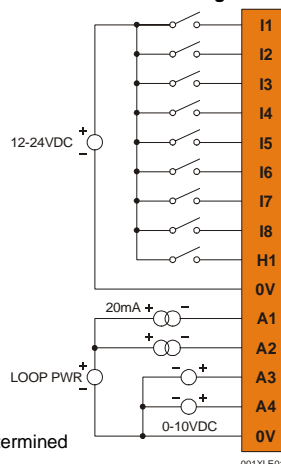


4.1 Wiring Examples

J1 Orange Terminal Connector	Name
I1	IN1
I2	IN2
I3	IN3
I4	IN4
I5	IN5
I6	IN6
I7	IN7
I8	IN8
H1	HSC1 / IN9
0V	Ground
A1	Analog IN1
A2	Analog IN2
A3	Analog IN3
A4	Analog IN4
0V	Ground

Note:
Loop Power requirements are determined by the transmitter specification.

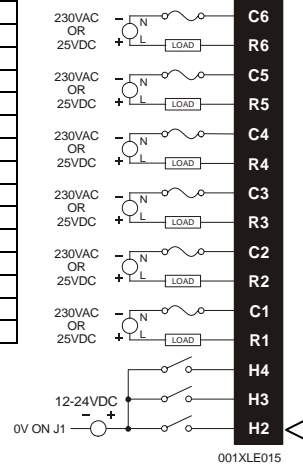
XT102 J1 Orange Positive Logic In Digital In / Analog In



4.1 Wiring Examples (continued)

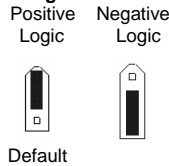
J2 Black Terminal Connector	Name
C6	Relay 6 COM
R6	Relay 6 NO
C5	Relay 5 COM
R5	Relay 5 NO
C4	Relay 4 COM
R4	Relay 4 NO
C3	Relay 3 COM
R3	Relay 3 NO
C2	Relay 2 COM
R2	Relay 2 NO
C1	Relay 1 COM
R1	Relay 1 NO
H4	HSC4 / IN12
H3	HSC3 / IN11
H2	HSC2 / IN10

J2 Black Positive Logic Digital In / Relay Out

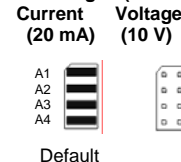


4.2 I/O Jumpers Settings (JP1 - JP2)

JP1 Digital DC In / HSC



JP2 Analog In (A1 - A4)



Note:
When using JP2 (A1-A4), each channel can be independently configured.

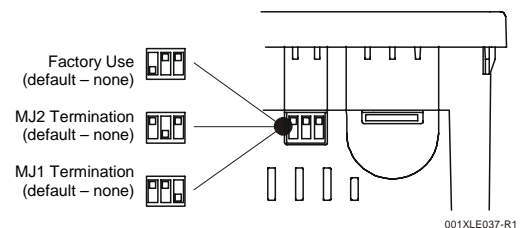
Note: The Cscape Module Setup configuration must match the selected I/O (JP) jumper settings.

4.3 External DIP Switch Settings

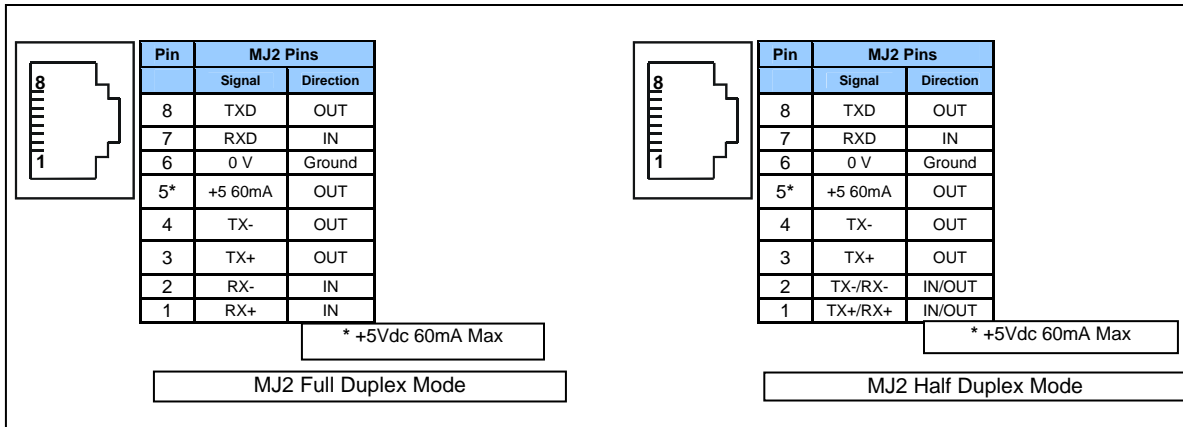
The External DIP Switches are used for termination of the RS-485 ports. The XLt is shipped un-terminated.

To terminate, select one of the jumpers shipped with the product and insert it based upon the option that is desired or, select the switch and configure based upon the option that is desired.

As seen when looking at the top of the XLt unit



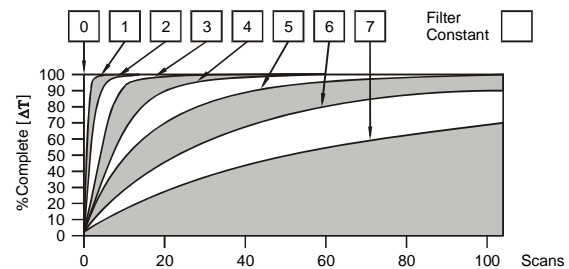
5 MJ2 Pinouts in Full and Half Duplex Modes



NOTES

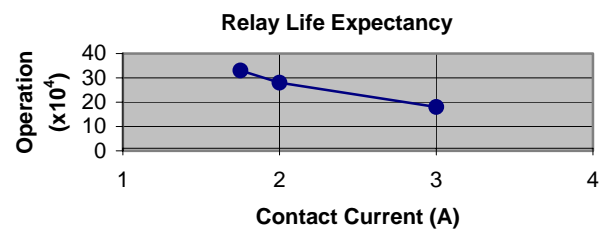
6 Filter

Filter Constant sets the level of digital filtering according to the following chart.



Digital Filtering. The illustration above demonstrates the effect of digital filtering (set with Filter Constant) on module response to a temperature change.

7 Derating



9 Safety

When found on the product, the following symbols specify:



Warning: Electrical Shock Hazard.



Warning: Consult user documentation.

WARNING: To avoid the risk of electric shock or burns, always connect the safety (or earth) ground before making any other connections.

WARNING: To reduce the risk of fire, electrical shock, or physical injury it is strongly recommended to fuse the voltage measurement inputs. Be sure to locate fuses as close to the source as possible.

WARNING: Replace fuse with the same type and rating to provide protection against risk of fire and shock hazards.

WARNING: In the event of repeated failure, do not replace the fuse again as a repeated failure indicates a defective condition that will not clear by replacing the fuse.

WARNING: Only qualified electrical personnel familiar with the construction and operation of this equipment and the hazards involved should install, adjust, operate, or service this equipment. Read and understand this manual and other applicable manuals in their entirety before proceeding. Failure to observe this precaution could result in severe bodily injury or loss of life.

- All applicable codes and standards need to be followed in the installation of this product.
- Adhere to the following safety precautions whenever any type of connection is made to the module:
 - Connect the safety (earth) ground on the power connector first before making any other connections.
 - When connecting to electric circuits or pulse-initiating equipment, open their related breakers.
 - Do not make connections to live power lines.
 - Make connections to the module first; then connect to the circuit to be monitored.
 - Route power wires in a safe manner in accordance with good practice and local codes.
 - Wear proper personal protective equipment including safety glasses and insulated gloves when making connections to power circuits.
 - Ensure hands, shoes, and floor are dry before making any connection to a power line.
 - Make sure the unit is turned OFF before making connection to terminals.
 - Make sure all circuits are de-energized before making connections.
 - Before each use, inspect all cables for breaks or cracks in the insulation. Replace immediately if defective.

- Use Copper Conductors in Field Wiring Only, 60/75° C

8 I/O Register Map

Registers	Description
%I1 to %I24	Digital Inputs
%I32	Output Fault
%I25 to %I31	Reserved
%Q1 to %Q16	Digital outputs
%Q17	Clear HSC1 accumulator to 0
%Q18	Totalizer: Clear HSC2 Quadrature 1-2: Accumulator 1 Reset to max – 1
%Q19	Clear HSC3 Accumulator to 0
%Q20	Totalizer: Clear HSC4 Quadrature 3-4: Accumulator 3 Reset to max – 1
%Q21 to %Q32	Reserved
%AI1 to %AI4	Analog inputs
%AI5, %AI6	HSC1 Accumulator
%AI7, %AI8	HSC2 Accumulator
%AI9, %AI10	HSC3 Accumulator
%AI11, %AI12	HSC4 Accumulator
%AQ1, %AQ2	PWM1 Duty Cycle
%AQ3, %AQ4	PWM2 Duty Cycle
%AQ5, %AQ6	PWM Prescale
%AQ7, %AQ8	PWM Period
%AQ9 to %AQ14	Analog outputs

Note: Not all XLt units contain the I/O listed in this table.

10 Technical Support

For assistance and manual updates, contact Technical Support at the following locations:

North America:
(317) 916-4274
www.heapg.com
email: techsppt@heapg.com

Europe:
(+) 353-21-4321-266
www.horner-apg.com
email: techsupport@homerirl.ie

"WARNING: EXPOSURE TO SOME CHEMICALS MAY DEGRADE THE SEALING PROPERTIES OF MATERIALS USED IN THE Tyco relay PCJ

Cover / case & base: Mitsubishi engineering Plastics Corp.
5010GN6-30 or 5010GN6-30 M8 (PBT)
Sealing Material: Kishimoto 4616-50K (I part epoxy resin)

It is recommended to periodically inspect the relay for any degradation of properties and replace if degradation is found

Information in this document is subject to change without notice. This document is the property of Horner APG and shall not be modified as to content unless specifically authorized.



XLT OCS Model:
HE-XT103 / HE-XT240C113 / HE-XT240C013
12 Digital DC Inputs / 12 Digital Outputs
2 Analog Inputs (Medium Resolution)

XLT OCS Model:
HE-XT104 / HE-XT240C114 / HE-XT240C014
24 Digital DC Inputs / 16 Digital Outputs
2 Analog Inputs (Medium Resolution)

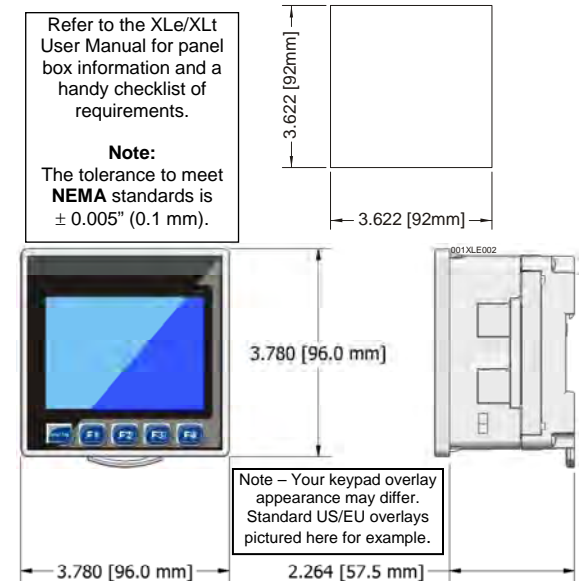
1 Specifications

Specifications						
Digital DC Inputs	XLT103		XLT104	Digital DC Outputs	XLT103	XLT104
Inputs per Module	12 including 4 configurable HSC inputs		24 including 4 configurable HSC inputs	Outputs per Module	12 including 2 configurable PWM outputs	16 including 2 configurable PWM outputs
Commons per Module	1			Commons per Module	1	
Input Voltage Range	12 VDC / 24 VDC			Output Type	Sourcing / 10 K Pull-Down	
Absolute Max. Voltage	35 VDC Max.			Absolute Max. Voltage	28 VDC Max.	
Input Impedance	10 k Ω			Output Protection	Short Circuit	
Input Current	Positive Logic	Negative Logic		Max. Output Current per point	0.5 A	
Upper Threshold	0.8 mA	-1.6 mA		Max. Total Current	4 A Continuous	
Lower Threshold	0.3 mA	-2.1 mA		Max. Output Supply Voltage	30 VDC	
Max Upper Threshold	8 VDC			Minimum Output Supply Voltage	10 VDC	
Min Lower Threshold	3 VDC			Max. Voltage Drop at Rated Current	0.25 VDC	
OFF to ON Response	1 ms			Max. Inrush Current	650 mA per channel	
ON to OFF Response	1 ms			Min. Load	None	
HSC Max. Switching Rate	10 kHz Totalizer/Pulse,Edges 5 kHz Frequency/Pulse,Width 2.5 kHz Quadrature			OFF to ON Response	1 ms	
Analog Inputs, Medium Resolution	XLT103	XLT104		ON to OFF Response	1 ms	
Number of Channels	2	2		Output Characteristics	Current Sourcing (Pos logic)	
Input Ranges Safe input voltage range Input Impedance (Clamped @ -0.5 VDC to 12 VDC)	0 - 10 VDC 0 – 20 mA 4 – 20 mA -0.5 V to +12V <u>Current Mode:</u> 100 Ω <u>Voltage Mode:</u> 500 k Ω					
Nominal Resolution %AI full scale Max. Over-Current	10 Bits 32,000 counts 35 mA			Required Power (Inrush)	30 A for 1 ms @ 24 VDC	
				Primary Power Range	10 – 30 VDC	
Conversion Speed	All channels converted once per ladder scan			Relative Humidity	5 to 95% Non-condensing	
Max. Error at 25°C (excluding zero)	4-20 mA 1.00% 0-20 mA 1.00% 0-10 VDC 0.50%			Operating Temperature	-10°C to +60°C	
Additional error for temperatures other than 25°C	TBD			Terminal Type	Screw Type,5 mm Removable	
				CE	See Compliance Table at http://www.heapp.com/Pages/TechSupport/ProductCert.html	
Filtering	160 Hz hash (noise) filter 1-128 scan digital running average filter			UL		
				Weight		12.5 oz. (354.36 g)
				Clock Accuracy		+/- One Minute/Month at 20C

Note: Highest usable frequency for PWM output is 65 KHz

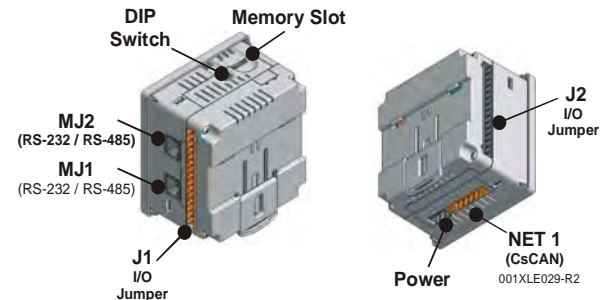
2 Panel Cut-Out and Dimensions

Note: Max. panel thickness: 5 mm.



3 Ports / Connectors / Cables

Note: The case of the XLT is black, but for clarity, it is shown in a lighter gray color.

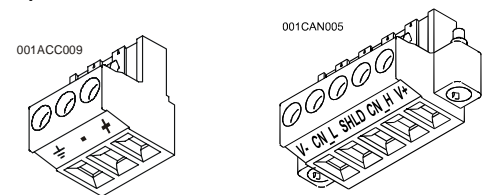


To Remove Back Cover:
Unscrew 4 screws located on the back of the unit and remove back cover.

CAUTION: Do not over tighten screws when replacing the back cover.

I/O Jumpers (Not Shown): I/O Jumpers (JP) are located internally. To access, remove back cover of unit.

Wiring Connectors (J1 - J4), I/O Jumpers (JP1-3), and External Jumpers (RS-485) are described in the **Wiring and Jumpers** section of this document.



Power Connector

CAN Connector

Power Up:
Connect to Earth Ground.
Apply 10 - 30 VDC.
Screen lights up.
Torque rating 4.5 - 7 Lb-In
(0.50 - 0.78 N-m)

Use the CAN Connector when using CsCAN network.

Torque rating 4.5 - 7 Lb-In
(0.50 - 0.78 N-m)

ECN P40_XLe-t_Data_Sheets

Section 3 continued

Memory Slot:

Uses **Removable Memory** for data logging, screen captures, program loading and recipes.

Horner Part No.: HE-MC1

Serial Communications:

MJ1: (RS-232 / RS-485) Use for Cscape programming and Application-Defined Communications.

MJ2: (RS-232 / RS-485) Use for Application-Defined Communications.

Pin	MJ1 Pins	MJ2 Pins
8	TXD	OUT
7	RXD	IN
6	0 V	Ground
5*	+5 60mA	OUT
4	RTS	OUT
3	CTS	IN
2	RX- / TX-	IN / OUT
1	RX+ / TX+	IN / OUT

* +5Vdc 60mA Max

4 Wiring and Jumpers

- Wire according to the type of inputs / outputs used and select the appropriate jumper option. Use Copper Conductors in Field Wiring Only, 60/75° C

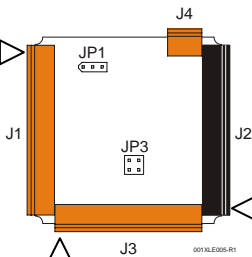
Wiring Specifications

Location of I/O jumpers (JP) and wiring connectors (J1 – J4).

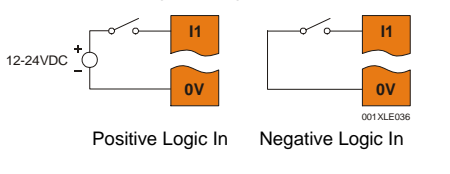
•For I/O wiring (discrete), use the following wire type or equivalent: Belden 9918, 18 AWG (0.8 mm²) or larger.

•For shielded Analog I/O wiring, use the following wire type or equivalent: Belden 8441, 18 AWG (0.8 mm²) or larger.

•For CAN wiring, use the following wire type or equivalent: Belden 3084, 24 AWG (0.2 mm²) or larger.


Positive Logic vs. Negative Logic Wiring

The XLt can be wired for Positive Logic inputs or Negative Logic inputs.


4.1 I/O Jumpers Settings (JP1 – JP3)

Note: The Cscape Module Setup configuration must match the selected I/O (JP) jumper settings.

JP1 Digital DC Inputs

Positive Logic Negative Logic



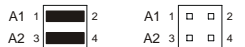
Default

JP3

CURRENT OR VOLTAGE INPUTS

20mA

10VDC


Note:

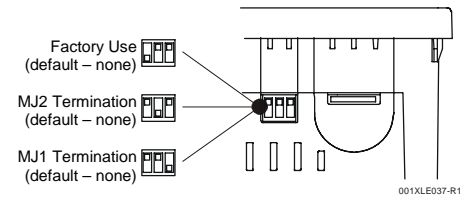
When using JP3 (A1-A2), each channel can be independently configured.

4.2 External DIP Switch Settings (or Jumpers Settings)

The External DIP Switches are used for termination of the RS-485 ports. The XLt is shipped un-terminated.

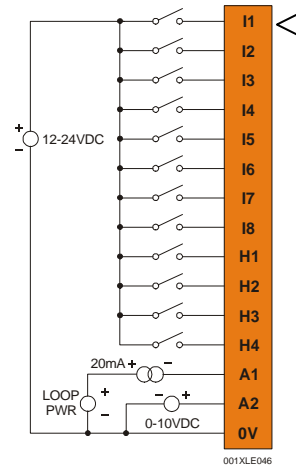
To terminate, select one of the jumpers shipped with the product and insert it based upon the option that is desired or, **select the switch** (as shown in the illustration) and configure based upon the option that is desired.

As seen when looking at the top of the XLt unit:


4.3 Wiring Examples

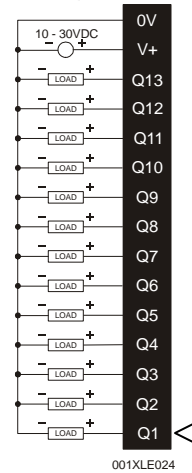
Note: The wiring examples show **Positive Logic** input wiring.

J1 Orange	XT103 / XT104 Name
I1	IN1
I2	IN2
I3	IN3
I4	IN4
I5	IN5
I6	IN6
I7	IN7
I8	IN8
H1	HSC1 / IN9
H2	HSC2 / IN10
H3	HSC3 / IN11
H4	HSC4 / IN12
A1	Analog IN1
A2	Analog IN2
0V	Ground

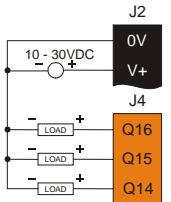
XT103 / 104 J1 Orange Positive Logic Digital In


Note: Loop Power requirements are determined by the transmitter specification.

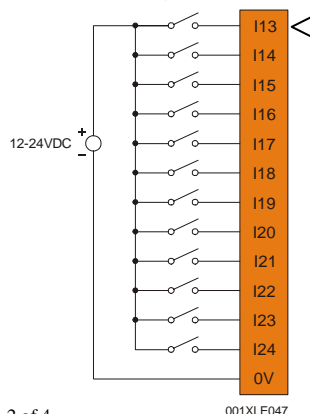
J2 Black	XT103	XT104
0V	Ground	
V+	V+ *	
NC	No Connect	OUT13
Q12	OUT12	
Q11	OUT11	
Q10	OUT10	
Q9	OUT9	
Q8	OUT8	
Q7	OUT7	
Q6	OUT6	
Q5	OUT5	
Q4	OUT4	
Q3	OUT3	
Q2	OUT2 / PWM2	
Q1	OUT1 / PWM1	
V+* Supply for Sourcing Outputs		

XT103 / 104 J2 Black Positive Logic Digital Out

XT104 J4 Orange Positive Logic Digital Out

J4 Orange	XT104
Q16	OUT16
Q15	OUT15
Q14	OUT14

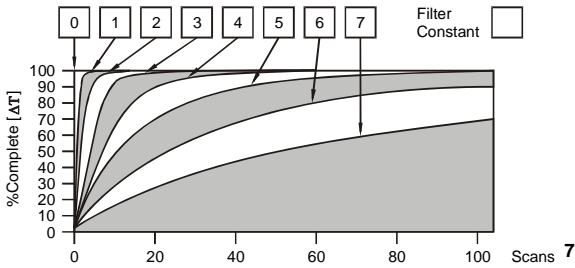


J3 Orange	XT104
I13	IN13
I14	IN14
I15	IN15
I16	IN16
I17	IN17
I18	IN18
I19	IN19
I20	IN20
I21	IN21
I22	IN22
I23	IN23
I24	IN24
0V	Ground

XT104 J3 Orange Positive Logic Digital In


5 Filter

Filter Constant sets the level of digital filtering according to the following chart.



Digital Filtering. The illustration above demonstrates the effect of digital filtering (set with Filter Constant) on module response to a temperature change.

6 I/O Register Map

Registers	Description
%I1 to %I24	Digital Inputs
%I32	Output Fault
%I25 to %I31	Reserved
%Q1 to %Q16	Digital outputs
%Q17	Clear HSC1 accumulator to 0
%Q18	Totalizer: Clear HSC2 Quadrature 1-2: Accumulator 1 Reset to max – 1
%Q19	Clear HSC3 Accumulator to 0
%Q20	Totalizer: Clear HSC4 Quadrature 3-4: Accumulator 3 Reset to max – 1
%Q21 to %Q32	Reserved
%AI1 to %AI4	Analog inputs
%AI5, %AI6	HSC1 Accumulator
%AI7, %AI8	HSC2 Accumulator
%AI9, %AI10	HSC3 Accumulator
%AI11, %AI12	HSC4 Accumulator
%AQ1, %AQ2	PWM1 Duty Cycle
%AQ3, %AQ4	PWM2 Duty Cycle
%AQ5, %AQ6	PWM Prescale
%AQ7, %AQ8	PWM Period
%AQ9 to %AQ14	Analog outputs

Note: Not all XLt units contain the I/O listed in this table.

Registers	PWM	HSC	Stepper
%AQ1	PWM1 Duty Cycle (32 bit)	HSC1 Preset Value	Start Frequency
%AQ2			Run Frequency
%AQ3	PWM2 Duty Cycle (32 bit)	HSC2 Preset Value	Accel Count (32 bit)
%AQ4			
%AQ5	PWM Prescale (32 bit)		Run Count (32 bit)
%AQ6			
%AQ7	PWM Period (32 bit)		Decel Count (32 bit)
%AQ8			
%Q1			Run
%I30			Ready/Done
%I31			Error

MJ2 Pinouts in Full and Half Duplex Modes

Pin	MJ2 Pins	
	Signal	Direction
8	TXD	OUT
7	RXD	IN
6	0 V	Ground
5*	+5 60mA	OUT
4	TX-	OUT
3	TX+	OUT
2	RX-	IN
1	RX+	IN

* +5Vdc 60mA max

Full Duplex Mode

Pin	MJ2 Pins	
	Signal	Direction
8	TXD	OUT
7	RXD	IN
6	0 V	Ground
5*	+5 60mA	OUT
4	TX-	OUT
3	TX+	OUT
2	TX-/RX-	IN/OUT
1	TX+/RX+	IN/OUT

* +5Vdc 60mA Max

Half Duplex Mode

8 Safety

When found on the product, the following symbols specify:



Warning: Electrical Shock Hazard.



Warning: Consult user documentation.

WARNING: To avoid the risk of electric shock or burns, always connect the safety (or earth) ground before making any other connections.

WARNING: To reduce the risk of fire, electrical shock, or physical injury it is strongly recommended to fuse the voltage measurement inputs. Be sure to locate fuses as close to the source as possible.

WARNING: Replace fuse with the same type and rating to provide protection against risk of fire and shock hazards.

WARNING: In the event of repeated failure, do not replace the fuse again as a repeated failure indicates a defective condition that will not clear by replacing the fuse.

WARNING: Only qualified electrical personnel familiar with the construction and operation of this equipment and the hazards involved should install, adjust, operate, or service this equipment. Read and understand this manual and other applicable manuals in their entirety before proceeding. Failure to observe this precaution could result in severe bodily injury or loss of life.

- All applicable codes and standards need to be followed in the installation of this product.
- Adhere to the following safety precautions whenever any type of connection is made to the module:
 - Connect the safety (earth) ground on the power connector first before making any other connections.
 - When connecting to electric circuits or pulse-initiating equipment, open their related breakers.
 - Do not make connections to live power lines.
 - Make connections to the module first; then connect to the circuit to be monitored.
 - Route power wires in a safe manner in accordance with good practice and local codes.
 - Wear proper personal protective equipment including safety glasses and insulated gloves when making connections to power circuits.
 - Ensure hands, shoes, and floor are dry before making any connection to a power line.
 - Make sure the unit is turned OFF before making connection to terminals.
 - Make sure all circuits are de-energized before making connections.
 - Before each use, inspect all cables for breaks or cracks in the insulation. Replace immediately if defective.
- Use Copper Conductors in Field Wiring Only, 60/75° C

9 Technical Support

For assistance and manual updates, contact Technical Support at the following locations:

North America:
(317) 916-4274
www.heapg.com
email: techspt@heapg.com

Europe:
(+) 353-21-4321-266
www.horner-apg.com
email: techsupport@hornerirl.ie

Information in this document is subject to change without notice. This document is the property of Horner APG and shall not be modified as to content unless specifically authorized.



XLT OCS Model:
HE-XT105 / HE-XT240C115 / HE-XT240C015
12 Digital DC Inputs / 12 Digital DC Outputs
2 Analog Inputs (High Resolution) / 2 Analog Outputs

Digital DC Inputs			Digital DC Outputs	
Inputs per Module	12 including 4 configurable HSC inputs		Outputs per Module	12 including 2 configurable PWM outputs
Commons per Module	1		Commons per Module	1
Input Voltage Range	12 VDC / 24 VDC		Output Type	Sourcing / 10 K Pull-Down
Absolute Max. Voltage	35 VDC Max.		Absolute Max. Voltage	28 VDC Max.
Input Impedance	10 k Ω		Output Protection	Short Circuit
Input Current	Positive Logic	Negative Logic	Max. Output Current per point	0.5 A
Upper Threshold	0.8 mA	-1.6 mA	Max. Total Current	4 A Continuous
Lower Threshold	0.3 mA	-2.1 mA	Max. Output Supply Voltage	30 VDC
Max Upper Threshold	8 VDC		Minimum Output Supply Voltage	10 VDC
Min Lower Threshold	3 VDC		Max. Voltage Drop at Rated Current	0.25 VDC
OFF to ON Response	1 ms		Max. Inrush Current	650 mA per channel
ON to OFF Response	1 ms		Min. Load	None
HSC Max. Switching Rate	10 kHz Totalizer/Pulse, Edges 5 kHz Frequency/Pulse, Width 2.5 kHz Quadrature		OFF to ON Response	1 ms
			ON to OFF Response	1 ms
			Output Characteristics	Current Sourcing (Positive Logic)
Analog Inputs, High Resolution				
Number of Channels	2		Thermocouple	Temperature Range
Input Ranges (Selectable)	0 - 10 VDC 0 - 20 mA 4 - 20 mA 100mV PT100 RTD, and J, K, N, T, E, R, S, B Thermocouples		B / R / S	2912°F to 32.0°F (1600°C to 0°C)
			E	1652°F to -328°F (900°C to -200°C)
			T	752.0°F to -400.0°F (400°C to -240°C)
			J	1382.0°F to -346.0°F (750°C to -210°C)
Safe input voltage range	10 VDC: -0.5 V to +15 V 20 mA: -0.5 V to +6 V RTD / T/C: \pm 24 VDC		K / N	2498.0°F to -400°F (1370°C to -240°C)
			Thermocouple Common Mode Range	\pm 10V
Nominal Resolution	10V, 20mA, 100mV: 14 Bits RTD, Thermocouple: 16 Bits		Converter Type	Delta Sigma
Input Impedance (Clamped @ -0.5 VDC to 12 VDC)	Current Mode: 100 Ω , 35mA Max. Continuous Voltage Mode: 500 k Ω , 35mA Max. Continuous		Max. Error at 25°C (*excluding zero)	*4-20 mA \pm 0.10%* *0-20 mA \pm 0.10%* *0-10 VDC \pm 0.10%* RTD (PT100) \pm 1.0 °C 0-100 mV \pm 0.05%
			Max Thermocouple Error (After Warm Up Time of One Hour)	\pm 0.2% (\pm 0.3% below -100°C)
%AI full scale	10 V, 20 mA, 100 mV: 32,000 counts full scale. RTD / T/C: 20 counts / °C		Conversion Speed, Both Channels Converted	10V, 20mA, 100mV: 30 Times/Second RTD, Thermocouple: 7.5 Times/Second
Max. Over-Current	35 mA		Conversion Time per Channel	10V, 20mA, 100mV: 16.7mS RTD, Thermocouple: 66.7mS
Open Thermocouple Detect Current	50 nA		RTD Excitation Current	250 μ A
Analog Outputs		General Specifications		
Number of Channels	2	Required Power (Steady State)	130 mA @ 24 VDC	
Output Ranges	0-10 VDC, 0-20 mA	Required Power (Inrush)	30 A for 1 ms @ 24 VDC	
Nominal Resolution	12 Bits	Primary Power Range	10 - 30 VDC	
Update rate	Once per PLC scan	Operating Temperature	-10° to 60° Celsius	
Minimum 10 V load	1 k Ω	Storage Temperature	14 to 140°F (-10 to 60°C)	
Maximum 20 mA load	500 Ω	Relative Humidity	5 to 95% Non-condensing	
Analog Outputs; Output Points Required	2	Filtering	15Hz hash (noise) filter 1-128 scan digital running average filter	
Maximum Error at 25°C (excluding zero)	0.1%	Terminal Type	Screw Type, 5 mm Removable	
		Weight	12.5 oz. (354.36)	
Additional error for temperatures other than 25°C	0.01% / °C	CE	See Compliance Table at http://www.heapg.com/Pages/TechSupport/ProductCert.html	
		UL		
		Clock Accuracy	\pm 1 Minute/Month at 20C	

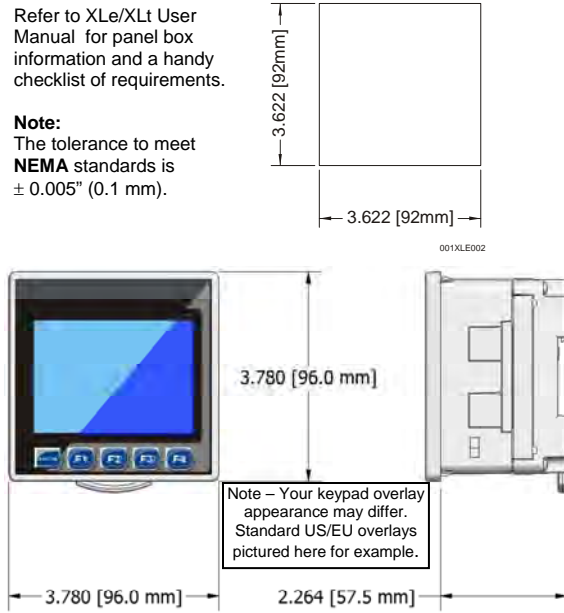
Note: Highest usable frequency for PWM output is 65 KHz

2 Panel Cut-Out and Dimensions

Note: Max. panel thickness: 5 mm.

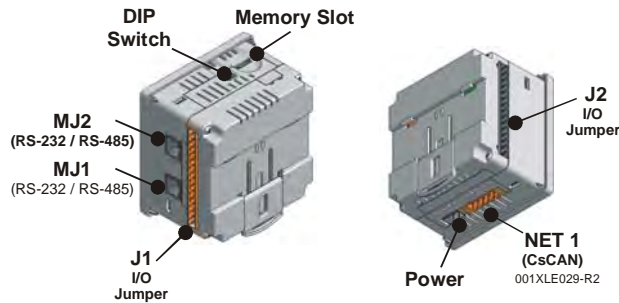
Refer to XLe/XLt User Manual for panel box information and a handy checklist of requirements.

Note:
The tolerance to meet NEMA standards is $\pm 0.005"$ (0.1 mm).



3 Ports / Connectors / Cables

Note: The case of the XLT is black, but for clarity, it is shown in a lighter gray color.



Memory Slot:
Uses **Removable Memory** for data logging, screen captures, program loading and recipes.
Horner Part No.: HE-MC1

Serial Communications:
MJ1: (RS-232 / RS-485) Use for Cscape programming and Application-Defined Communications.

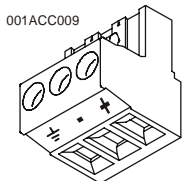
MJ2: (RS-232 / RS-485) Use for Application-Defined Communications.

To Remove Back Cover:
Unscrew 4 screws located on the back of the unit.
Remove Cover.

CAUTION:
Do not over tighten screws when replacing the back cover.

I/O Jumpers (Not Shown): I/O Jumpers (JP) are located internally. To access, remove back cover of unit.

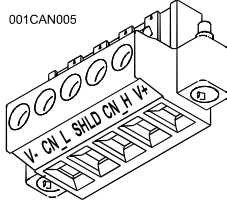
Wiring Connectors (J1 – J3), I/O Jumpers (JP1 – JP4), and External Jumpers (RS-485) are described in the **Wiring and Jumpers** section of this document.



Power Connector

Power Up:
Connect to Earth Ground.
Apply 10 - 30 VDC.
Screen lights up.

Torque rating 4.5 – 7 Lb-In
(0.50 – 0.78 N-m)



CAN Connector

Use the CAN Connector when using CsCAN network.

Torque Rating 4.5 – 7 Lb-In
(0.50 – 0.78 N-m)

Pin	MJ1 Pins		MJ2 Pins	
	Signal	Direction	Signal	Direction
8	TXD	OUT	TXD	OUT
7	RXD	IN	RXD	IN
6	0 V	Ground	0 V	Ground
5*	+5 60mA	OUT	+5 60mA	OUT
4	RTS	OUT	TX-	OUT
3	CTS	IN	TX+	OUT
2	RX- / TX-	IN / OUT	TX-/RX-	IN
1	RX+ / TX+	IN / OUT	TX+/RX+	IN

* +5Vdc 60mA Max

4 Wiring and Jumpers

- Wire according to the type of inputs / outputs used and select the appropriate jumper option. Use Copper Conductors in Field Wiring Only, 60/75° C

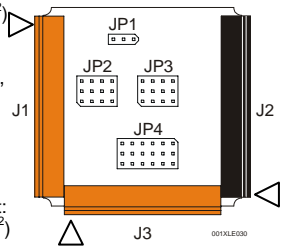
Wiring Specifications

- For I/O wiring (discrete), use the following wire type or equivalent: Belden 9918, 18 AWG (0.8 mm²) or larger.

- For shielded Analog I/O wiring, use the following wire type or equivalent: Belden 8441, 18 AWG (0.8 mm²) or larger.

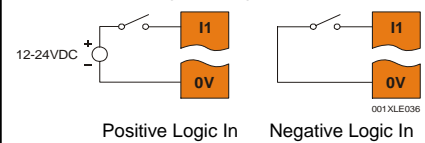
- For CAN wiring, use the following wire type or equivalent: Belden 3084, 24 AWG (0.2 mm²) or larger.

Location of I/O jumpers (JP) and wiring connectors (J1 – J3).



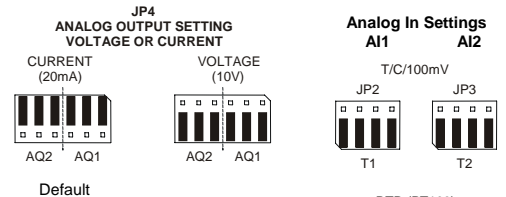
Positive Logic vs. Negative Logic Wiring

The XLe can be wired for Positive Logic inputs or Negative Logic inputs.



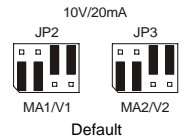
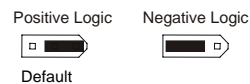
4.1 I/O Jumpers Settings (JP1 – JP4)

Note: The Cscape Module Setup configuration must match the selected I/O (JP) jumper settings.



Note: When using JP4 (output) or JP2 / JP3 (inputs), each channel can be independently configured. For example, JP2 can be configured for 10 V and JP3 can be configured as an RTD.

JP1 Digital DC Inputs

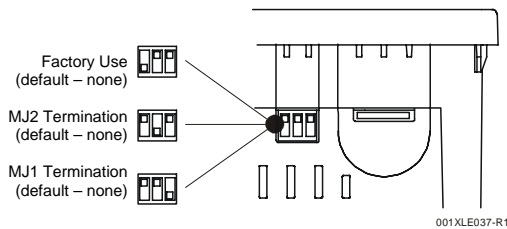


4.2 External DIP Switch Settings (or Jumpers Settings)

The External DIP Switches are used for termination of the RS-485 ports. The XLT is shipped un-terminated.

To terminate, select one of the jumpers shipped with the product and insert it based upon the option that is desired or, select the switch and configure based upon the option that is desired.

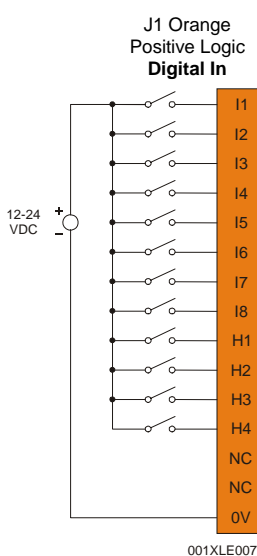
As seen when looking at the top of the XLT unit: Refer to Section 3 for the location of the External Jumpers.



4.3 Wiring Examples

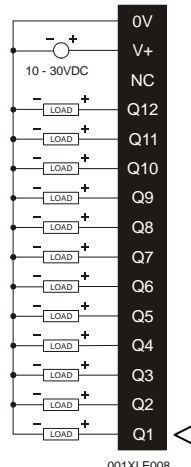
Note: The wiring examples show **Positive Logic** input wiring.

J1 Orange	Name
I1	IN1
I2	IN2
I3	IN3
I4	IN4
I5	IN5
I6	IN6
I7	IN7
I8	IN8
H1	HSC1 / IN9
H2	HSC2 / IN10
H3	HSC3 / IN11
H4	HSC4 / IN12
NC	No Connect
NC	No Connect
0V	Ground



J2 Black	Name
0V	Ground
V+*	V+*
NC	No Connect
Q12	OUT12
Q11	OUT11
Q10	OUT10
Q9	OUT9
Q8	OUT8
Q7	OUT7
Q6	OUT6
Q5	OUT5
Q4	OUT4
Q3	OUT3
Q2	OUT2 / PWM2
Q1	OUT1 / PWM1
V+* Supply for Sourcing Outputs	

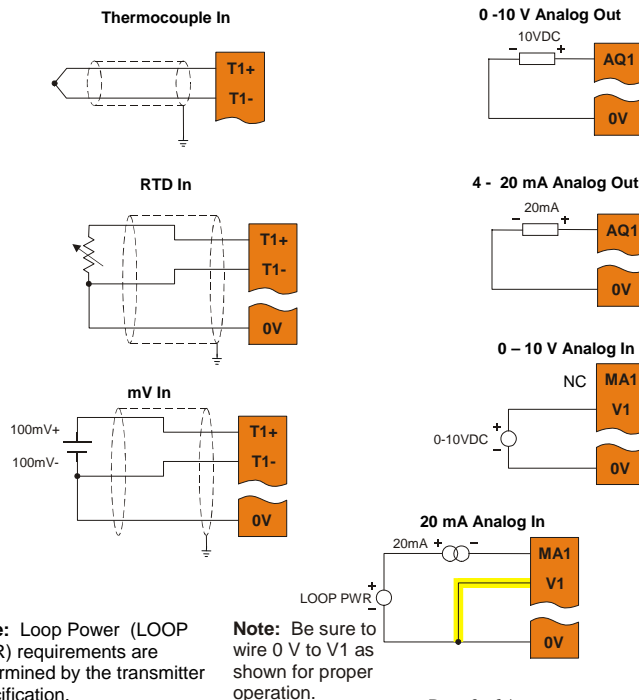
J2 Black Positive Logic Digital Outputs



J3 Orange	Name
T1+	T/C / RTD IN1+ / 100 mV+
T1-	T/C / RTD IN1- / 100 mV-
T2+	T/C / RTD IN2+ / 100 mV+
T2-	T/C / RTD IN2- / 100 mV-
AQ1	10 V / 20 mA OUT1
AQ2	0 V / 20 mA OUT2
0V	Ground
MA1	20 mA IN1
V1	10 V IN1
0V	Ground
MA2	20 mA IN2
V2	10 V IN2
0V	Ground

J3 Orange Analog In / Analog Out

Note: A total of 2 Analog Inputs can be used (T/C, RTD, mV, mA, and V).



Note: Loop Power (LOOP PWR) requirements are determined by the transmitter specification.

Note: Be sure to wire 0 V to V1 as shown for proper operation.

5 I/O Register Map

Registers	Description
%I1 to %I24	Digital Inputs
%I32	Output Fault
%I25 to %I31	Reserved
%Q1 to %Q16	Digital outputs
%Q17	Clear HSC1 accumulator to 0
%Q18	Totalizer: Clear HSC2 Quadrature 1-2: Accumulator 1 Reset to max - 1
%Q19	Clear HSC3 Accumulator to 0
%Q20	Totalizer: Clear HSC4 Quadrature 3-4: Accumulator 3 Reset to max - 1
%Q21 to %Q32	Reserved
%AI1 to %AI4	Analog inputs
%AI5, %AI6	HSC1 Accumulator
%AI7, %AI8	HSC2 Accumulator
%AI9, %AI10	HSC3 Accumulator
%AI11, %AI12	HSC4 Accumulator
%AQ1, %AQ2	PWM1 Duty Cycle
%AQ3, %AQ4	PWM2 Duty Cycle
%AQ5, %AQ6	PWM Prescale
%AQ7, %AQ8	PWM Period
%AQ9 to %AQ14	Analog outputs

Note: Not all XLe units contain the I/O listed in this table.

Registers	PWM	HSC	Stepper
%AQ1	PWM1 Duty Cycle (32 bit)	HSC1 Preset Value	Start Frequency
%AQ2	PWM2 Duty Cycle (32 bit)	HSC2 Preset Value	Run Frequency
%AQ3	PWM2 Duty Cycle (32 bit)		Accel Count (32 bit)
%AQ4	PWM Prescale (32 bit)		Run Count (32 bit)
%AQ5	PWM Prescale (32 bit)		Decel Count (32 bit)
%AQ6	PWM Period (32 bit)		
%AQ7			
%AQ8			
%Q1			Run
%I30			Ready/Done
%I31			Error

6 MJ2 Pinouts in Full and Half Duplex Modes

Pin	MJ2 Pins	Signal	Direction
8	TXD	OUT	
7	RXD	IN	
6	0 V	Ground	
5*	+5 60mA	OUT	
4	TX-	OUT	
3	TX+	OUT	
2	RX-	IN	
1	RX+	IN	

* +5Vdc 60mA Max

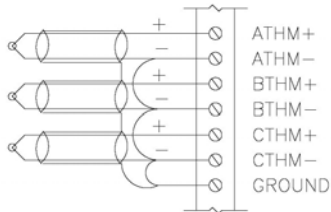
Pin	MJ2 Pins	Signal	Direction
8	TXD	OUT	
7	RXD	IN	
6	0 V	Ground	
5*	+5 60mA	OUT	
4	TX-	OUT	
3	TX+	OUT	
2	TX-/RX-	IN/OUT	
1	TX+/RX+	IN/OUT	

7 Digital Filtering for Analog Inputs

The digital filter is updated once per conversion. It is an "IIR" running average filter that emulates a simple RC filter. The equivalent time constant is determined by the Filter Constant and the sum of the conversion times for the two channels. The Filter Constant determines the weight given to the most recent conversion. The following table lists the equivalent time constant for the three possible total conversion times, which are dependent upon the two input mode selections. This filter delay is in addition to the PLC scan delay.

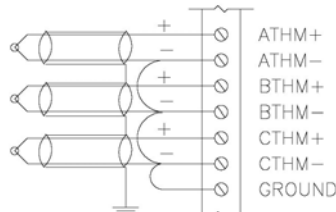
Equivalent RC Time Constant in Seconds (Nominal time to reach 63% of final value.)			
Total Conversion Time in Seconds			
Filter Constant	0.03	0.09	0.13
0*	0.03*	0.09*	0.13*
1	0.07	0.18	0.27
2	0.13	0.35	0.53
3	0.27	0.71	1.07
4	0.53	1.41	2.13
5	1.07	2.83	4.27
6	2.14	5.65	8.54
7	4.28	11.30	17.08

* No filter delay, reading is unfiltered conversion value

8 Thermocouple Grounding Schemes

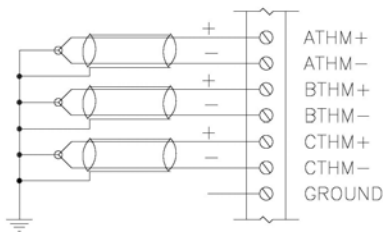
Ungrounded Thermocouples

Alternate Shield Connection for Ungrounded Thermocouples.



Ungrounded Thermocouples

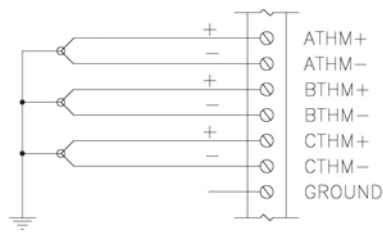
Preferred Shield Connection for Ungrounded Thermocouples.



Grounded Thermocouples

Field Ground Potential Less Than Seven Volts AC

Typical Shield Connection for Grounded Thermocouples



Grounded Thermocouples

Field Ground Potential Less Than Seven Volts AC

Shields Connected at One End Only May be Used to Reduce Noise

Grounded Thermocouples May Use the Ungrounded Thermocouple Shield Connections if the Shield is not Grounded at the Field End

Note: The examples for thermocouple grounding schemes above are generic illustrations. The XT105 has two thermocouple inputs.

9 Safety

When found on the product, the following symbols specify:



Warning: Electrical Shock Hazard.



Warning: Consult user documentation.

WARNING: To avoid the risk of electric shock or burns, always connect the safety (or earth) ground before making any other connections.

WARNING: To reduce the risk of fire, electrical shock, or physical injury it is strongly recommended to fuse the voltage measurement inputs. Be sure to locate fuses as close to the source as possible.

WARNING: Replace fuse with the same type and rating to provide protection against risk of fire and shock hazards.

WARNING: In the event of repeated failure, do not replace the fuse again as a repeated failure indicates a defective condition that will not clear by replacing the fuse.

WARNING: Only qualified electrical personnel familiar with the construction and operation of this equipment and the hazards involved should install, adjust, operate, or service this equipment. Read and understand this manual and other applicable manuals in their entirety before proceeding. Failure to observe this precaution could result in severe bodily injury or loss of life.

• All applicable codes and standards need to be followed in the installation of this product.

• Adhere to the following safety precautions whenever any type of connection is made to the module:

• Connect the safety (earth) ground on the power connector first before making any other connections.

• When connecting to electric circuits or pulse-initiating equipment, open their related breakers.

• Do not make connections to live power lines.

• Make connections to the module first; then connect to the circuit to be monitored.

• Route power wires in a safe manner in accordance with good practice and local codes.

• Wear proper personal protective equipment including safety glasses and insulated gloves when making connections to power circuits.

• Ensure hands, shoes, and floor are dry before making any connection to a power line.

• Make sure the unit is turned OFF before making connection to terminals.

• Make sure all circuits are de-energized before making connections.

• Before each use, inspect all cables for breaks or cracks in the insulation. Replace immediately if defective.

• Use Copper Conductors in Field Wiring Only, 60/75° C

10 Technical Support

For assistance and manual updates, contact Technical Support at the following locations:

North America:

(317) 916-4274

www.heapg.com

email: techspt@heapg.com

Europe:

(+) 353-21-4321-266

www.horner-appg.com

email:

techsupport@hornerirl.ie

Information in this document is subject to change without notice. This document is the property of Horner APG and shall not be modified as to content unless specifically authorized.

- **Emotron-F1 M10 Shaft Power Monitor**



EL-FI® M10

SHAFT POWER MONITOR INSTRUCTION MANUAL

Motor shaft output power measurement



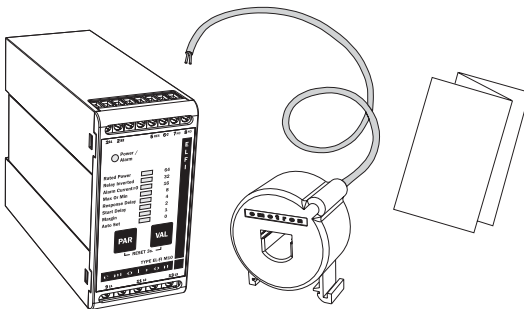
1 INSIDE THE BOX ...

This instruction manual describes the installation and commissioning of the M10 load monitor. The M10 supervises induction motor driven equipment and provides alarms when abnormal conditions are detected. If the machines “normal” load level is exceeded, the internal relay change state and the alarm LED turns red. The output relay contact can be used for alarm indication and/or machine shut-down. The M10 is ideal for many different applications; e.g. as an electronic shear pin and as pump dry running protection, for motors up to 50A. The unit is intended for price sensitive applications that only demand non-complex protection against under- or overload. For more advanced load monitoring the EL-FI M20 must be used.

- Check the delivery. Your shipment should contain the M10 load monitor, a current transformer and this instruction manual.
- Check carefully that the ordered equipment complies with the motors input voltage and that the current transformer rating is as stated on the delivery packaging.
- Check that the contents have not been damaged in shipping.

Note!

If in doubt contact your supplier before starting to install or commissioning the product.



2 SAFETY

- Study this manual thoroughly before installing and using the monitor.
- The monitor must be installed by qualified personal.
- Always disconnect supply circuits prior to installing.
- The installation must comply with standard and local regulations.
- Pay special attention to this SAFETY section and the parts marked “CAUTION!” in sections 4 and 6.
- Should questions or uncertainties arise, please contact your local sales outlet or see chapter 9, SERVICE.

Note!

Removing or breaking the seal on the housing will invalidate the warranty.

3 WIRING

This wiring example shows how the M10 can be used to control the starting and stopping circuit of the motor. Other wiring configurations are possible.

1. The current transformer CTMxxx must be placed in the same phase that is connected to terminal 9, phase L1.
2. For single-phase connection see fig. 2.

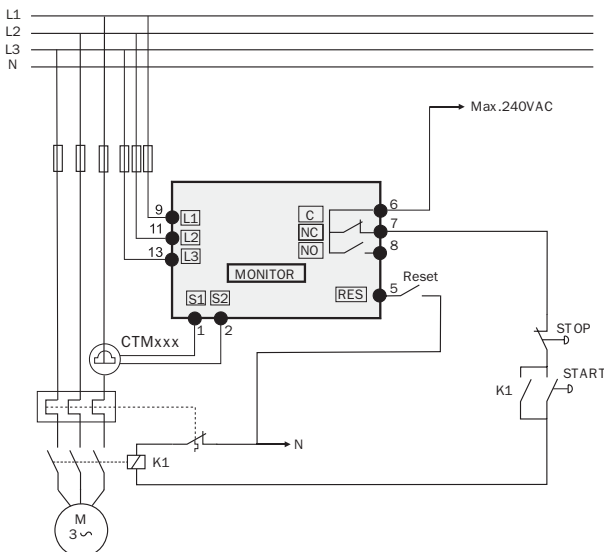


Fig 1. Standard wiring 3-phase motors.

Note!

If the START/STOP is connected according to fig. 1, it is recommended that terminals 6 and 7 be by-passed during settings. After the settings are completed the by-pass must be taken out.

ALTERNATIVE EXAMPLE FOR SINGLE-PHASE CONNECTION

This wiring example shows the alternative connection to be made with regard to a single-phase connection. Refer to fig. 1 for the remaining wiring.

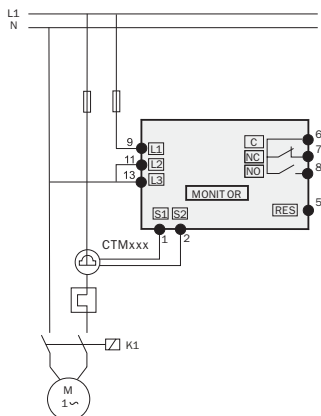


Fig 2. Single-phase wiring example.

LATCHED OR UN-LATCHED ALARM

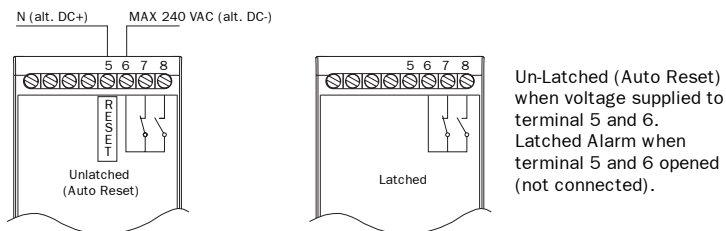


Fig 3. Wiring example for latched or un-latched alarm.

4 SELECTION CURRENT TRANSFORMER

FOR MOTORS UP TO 50 A

1. Check the rated motor current on the motor plate.
2. Compare this value with the Rated Motor Current in table 1.
3. From table 1, select the current transformer and the appropriate numbers of windings.

RATED MOTOR CURRENT (A)	CTM010	CTM025	CTM050
0.40 - 1.00	10		
1.01 - 2.00	5		
2.01 - 3.0	3		
3.1 - 5.0	2		
5.1 - 10.0	1		
10.1 - 12.5		2	
12.6 - 25		1	
26 - 50A			1

Table 1. Current transformer and number of primary windings.

Example

- Rated motor current = 12 A.
- Select 10.1 – 12.5 from the first colon in table 1 and choose CTM 025 with two (2) primary windings.

Note!

Max length of CTM cable is 1 m (39.37 in). For motors with rated current over 50 A contact your supplier.

CAUTION!

Terminals 1 and 2 (S1, S2) carry live voltage.

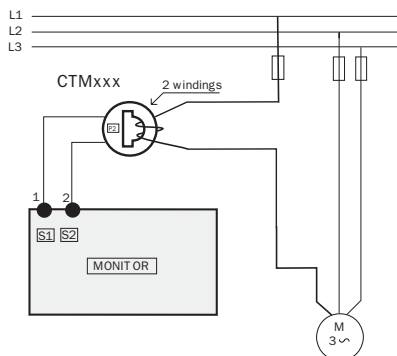


Fig 4. Example: CTM 025 with 2 windings for an 12 A motor.

Note!

Normally the appropriate Current Transformer (CTM xxx) will have been ordered and shipped with the M10, check that this is the case; contact the supplier if in doubt.



Fig 5. Example 1 and 3 windings.

Note!

The transformer connection and orientation are not polarity sensitive, but must be connected to L1.

5 OPERATION

LED

- A constant green LED indicates a parameter type.
- A flashing green LED indicates a value.

Under normal system operation, the eight LED's are all off (see table 2). Any LED's illuminated will be automatically switched off 30 seconds after the last key press.

AUTO SET

The alarm load level is automatically set by the AutoSet function, see section 6.

Current input

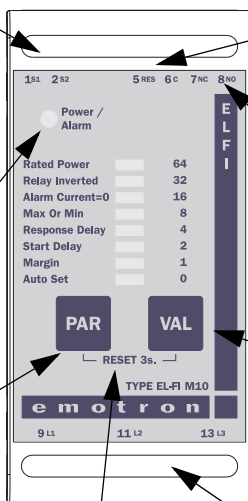
Terminal 1 and 2. Current Transformer; CTM 010, 025 or 050 (Max 50 A motor).

Power/Alarm

The Power/Alarm LED indicates green at "power on" and at normal load. Red at alarm.

PAR

Parameter change (LED light constant green) - pressing PAR key when parameter is displayed proceeds to next parameter.



Reset

Reset a latched alarm by pressing both PAR and VAL at the same time in 3 s.

Reset input

Terminal 5 and 6 are used for external reset and selection of latched/unlatched alarm.

Relay output

Terminal 6, 7 and 8 output relay.

VAL

Value setting - Pressing VAL key when green LED is flashing increases value. A changed value is confirmed by pressing PAR.

Motor terminals

Terminal 9 (L1), 11 (L2) and 13 (L3) for supply and motor voltage input.

The value for a parameter, e.g. seconds, kW, HP or margin, can only be set as 0, 1, 2, 4, 8, 16, 32 or 64. Select closest value.

6 PROGRAMMING

Set-up the monitor as below:

CAUTION!

Make sure that all safety measures have been taken before switching on the supply voltage and starting the motor/machine in order to avoid personal injury.

Set-up and first start

- A. Switch on the supply voltage – Power LED turns green.
- B. Press **PAR** once – “LED” AUTO SET turns green.
- C. Keep pressing **PAR** until the desired parameter is selected e.g. RATED POWER, see table 2 and 3.
- D. Press **VAL** – Factory set value or earlier set value flashes e.g. “64”.
- E. Keep pressing **VAL** until desired value is displayed (0 – 64).
- F. Confirm chosen value by pressing **PAR**.
- G. Press **PAR** again and repeat steps B to F for all parameters except for AUTO SET. See table 2, 3 and fig. 6 for possible value setting for each of the eight parameters.
- H. Start and run motor/system at normal load conditions, also wait until the START DELAY has expired.

Hint!

Short-circuit the output relay during the set-up, this prevents the equipment to stopping unintentionally, see **Note!** in section “Wiring”.

- I. Press **PAR** once – “LED” AUTO SET turns green.
- J. Press and hold **VAL** for 3 seconds, at normal machine load. The Auto Set load level is automatically set and the LED is switched off.
- K. Set/re-set e.g. start delay, response delay, margin etc. if necessary (see table 2, 3 and fig. 6).

Example: Conveyor with overload protection

Conveyor with overload protection, motor 11 kW (fig. 6).

1. Check output power on motor plate and see table 3 (11 kW = Rated Motor Power 6.1- 12) – setting 8.
2. Switch on the supply voltage – Power LED green.
3. Press **PAR** once – “LED” AUTO SET turns green.
4. Keep pressing **PAR** until RATED POWER is selected.
5. Press **VAL** – Value “64” flashes (factory setting).
6. Set recommended value according to table 3. Keep pressing **VAL** until chosen value (8) flashes.
7. Confirm chosen value by pressing **PAR**.
8. Press **PAR** again and select MAX.
9. Press **VAL**. Chose the factory setting MAX – Overload Protection – “1”.
10. Confirm chosen value (1) by pressing **PAR**.
11. Press **PAR** again and select RELAY INVERTED.
12. Press **VAL**. Chose the factory setting “no” = “0”.
13. Confirm chosen value (0) by pressing **PAR**.

The above parameters are necessary to set for safe functioning. Note that “Rated power” for the motor must be set before Auto Set.

Hint!

Change the load on the machine to find out if appropriate load limit margin is set correctly. You can also reduce the margin by one or more steps to find out at what level the machine will trip. See fig. 6. Set/reset e.g start delay, response delay, trip margin etc. if necessary (see table 2).

More Hints!

- If the alarm level is difficult to set – simply perform an Auto Set when the motor is stopped. Then start the machine, run at normal load and perform an Auto Set again.
- If a wrong value is unintentionally set – simply set a new value. If the value is not confirmed by pressing PAR, the new value is not accepted (time out after 30 seconds).

Parameter	Value	Factory setting	Note
RATED POWER	0 1 2 4 8 16 32 64	64	See table 3
RELAY INVERTED	0 (no) 1 (yes)	0	0 = Relay activated at alarm
ALARM CURRENT = 0	0 (no) 1 (yes)	0	Alarm at no motor current
MAX OR MIN	0 (MIN) 1 (MAX)	1	0 = under load 1 = overload alarm
RESPONSE DELAY	0 1 2 4 8 16 32 64	2	Response delay in seconds (0=50 ms)
START DELAY	0 1 2 4 8 16 32 64	2	Start delay in seconds
MARGIN (% of rated power)	0 1 2 4 8 16 32 64	8	Load change for alarm sensitivity, fig. 6
AUTO SET	AutoSet load level is automatically set if VAL key is pressed for 3 seconds.		VAL key must be pressed when LED parameter AUTO SET is light. LED bar is switched off when AutoSet level is set.

Table 2. Parameters and values.

Setting	Rated motor power in kW or HP
0	0 - 0.5
1	0.51 - 1.5
2	1.51 - 2.5
4	2.51 - 6
8	6.1 - 12
16	12.1 - 24
32	24.1 - 48
64	48.1 - 75

Table 3. Setting of rated motor power.

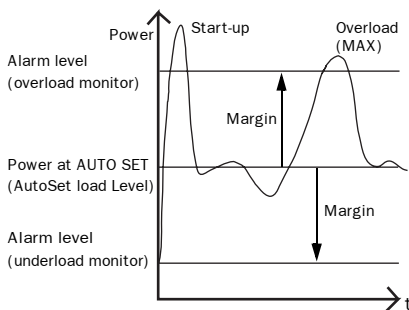
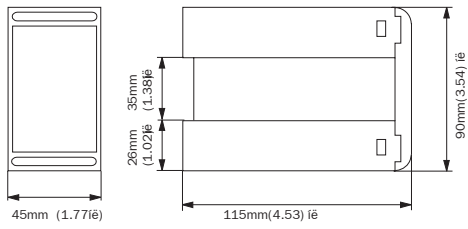


Fig 6. Alarm level and margin.

7 TECHNICAL DATA

Dimensions (WxHxD)	45x90x115 mm (1.77" x 3.54" x 4.53")
	 <p>The drawing shows two views of the unit. The front view on the left is a rectangle with a width of 45mm (1.77 in). The side view on the right shows the unit's profile with a total height of 90mm (3.54 in). The side view is divided into two main sections: a top section that is 35mm (1.38 in) high and a bottom section that is 26mm (1.02 in) high. The total width of the unit is 115mm (4.53 in). There are two small rectangular features on the side view, one in each section, likely representing mounting points or sensors.</p>
Mounting	35 mm DIN-rail 46277
Weight	175 g (5.65 oz)
Supply voltage	1x100-240 ($\pm 10\%$) 3x100-600 ($\pm 10\%$) 3x600-690 ($\pm 10\%$)
Frequency	50 or 60 Hz
Current input	Current transformers; CTM 010, 025 or 050 (Max 50 A motor)
Power consumption	Max 3 W
Start-up delay	1-64 s
Response delay	0.05-64 s
Relay output	5 A / 240 VAC Resistive, 1.5 A / 240 VAC Pilot duty / AC12
Fuse	Max 10 A
Terminal wire size	Use 75°C copper (CU) wire only. 0.2-4.0 mm ² single core (AWG12). 0.2-2.5 mm ² flexible core (AWG14), stripp length 8 mm (0.32")
Terminal tightening torque	0.56-0.79 Nm (5-7 lb-in)
Repeatability	$\pm 2.5\%$ FS, 24 H, @ +25 °C (+77°F)
Temperature tolerance	<0.1%/°C
External RESET on term. 5	Max 240 VAC or 48 VDC. High: ≥ 24 VAC/DC Low: < 1 VAC/DC. Reset >50 ms
Operating temperature	-20 (4°F) – +50 °C (+122°F)
Storage temperate	-30 (22°F) – +80 °C (+176°F)
Protection class	IP20
Approved to	CE, cUL and UL and CSA standard (up to 600 V)

Dismantling and disposal

The housing is made of recyclable plastic, PC/ABS and the circuit board contain small amount of tin and lead. When disposing, the parts must be handled and recycled in accordance with local regulations.

EU (European Union) specifications

EMC	EN 50081-1, EN 50081-2, EN 50082-1, EN 61000-6-2
Electrical safety	IEC 947-5-1
Rated insulated voltage	690 V
Rated impulse withstand voltage	4000V
Pollution degree	2
Terminals 5, 6, 7 and 8 are basic insulated from the line.	

US specifications

FCC (Federal Communications Commission)

This equipment has been tested and found to comply with the limits for a class A digital device pursuant to the Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference, in which case, the user will be required to correct the interference at their own expense.

Canada specifications

DOC (Department of communications)

This digital apparatus does not exceed the Class A limits for radio noise emissions from digital apparatus as set out in the Canadian interference-Causing Equipment Regulations. Le présent appareil numérique n'émet pas de bruits radio-électriques dépassant les limites applicables aux appareils numériques de la Classe A prescrite dans le Règlement sur le brouillage radioélectrique édicté du Canada.

8 PARAMETER LIST

Parameter	Factory setting	Actual setting	Alt. setting
RATED POWER	64		
RELAY INVERTED	0		
ALARM CURRENT = 0	0		
MAX OR MIN	1		
RESPONSE DELAY	2		
START DELAY	2		
MARGIN	8		

TERMINALS

Terminal	Label	Function
1	S1	Current transformer input for CTM 010, CTM 025 or CTM 050 ¹
2	S2	Current transformer input ¹
3		
4		
5	RES	Reset input. Latched or unlatched alarm is selected via this input. Connect to + at DC.
6	C	Alarm relay common and also reset common. Connect to “-” at DC.
7	NC	Alarm relay normally closed
8	NO	Alarm relay normally open
9	L1	Motor voltage phase L1
10		
11	L2	Motor voltage phase L2 (N for single phase motors) ²
12		
13	L3	Motor voltage phase L3 (N for single phase motors) ²

¹ Note! Terminals 1 and 2 (S1, S2) carry line voltage.

² N must be connected to terminal 11 and 13 (single phase).

9 SERVICE

This manual is valid for the following model:

EL-FI M10

Document number: 01-2550-01

Document version: r2

Date of release: 2003-04-15

Emotron AB reserves the right to alter product specifications without prior notification. No part of this document may be reproduced without permission from Emotron AB.

For more information contact your local sales outlet or one of the Emotron companies below or visit us at: **www.emotron.com**

Emotron AB, Headquater, **Sweden**

Mörsaregatan 12, Box 222 25

SE-250 24 Helsingborg, Sweden

Tel. +46 42 169900

Fax +46 42 169949

Emotron Antriebssysteme GmbH, **Germany**

Tel. +49 3943 92050

Fax +49 3943 92055

Emotron B.V., The **Netherlands & Belgium**

Tel. +31 497 389222

Fax +31 497 386275

Emotron El-Fi SA, **Spain**

Tel. +34 93 209 14 99

Fax +34 93 209 12 45

Emotron Inc., **USA**

Tel. +1 (419) 841-7774

Fax +1 (419) 843-5816

K.K. El-Fi, **Japan**

Tel. +81 42 528 88 20

Fax +81 42 528 88 21

Protected by utility patent SE 9703952-3

International utility patent application pending WO 9925049

- Endress + Hauser FMU-30 Level Transmitter



Level



Pressure



Flow



Temperature

Liquid
Analysis

Registration

Systems
Components

Services



Solutions

Technical Information

Prosonic T FMU30

Ultrasonic Level Measurement

Compact transmitters for non-contact level measurement of fluids, pastes and coarse bulk materials



Application

- Continuous, non-contact level measurement in fluids, pastes, sullages and coarse bulk materials
- System integration via 4 to 20mA
- Maximum measuring range:
 - 1½" sensor: 5 m (16 ft) in fluids
2 m (6 ft) in bulk materials
 - 2" sensor: 8 m (26 ft) in fluids
3.5 m (11 ft) in bulk materials

Features and benefits

- Quick and simple commissioning via menu-guided on-site operation with four-line plain text display
- Envelope curves on the on-site display for simple diagnosis
- Linearisation function (up to 32 points) for conversion of the measured value into any unit of length, volume or flow rate
- Non-contact measurement method minimizes service requirements
- Installation possible from thread G 1½" or 1½ NPT upwards
- Integrated temperature sensor for automatic correction of the temperature dependent sound velocity

TJ440F/00/EN/12.09
71105940

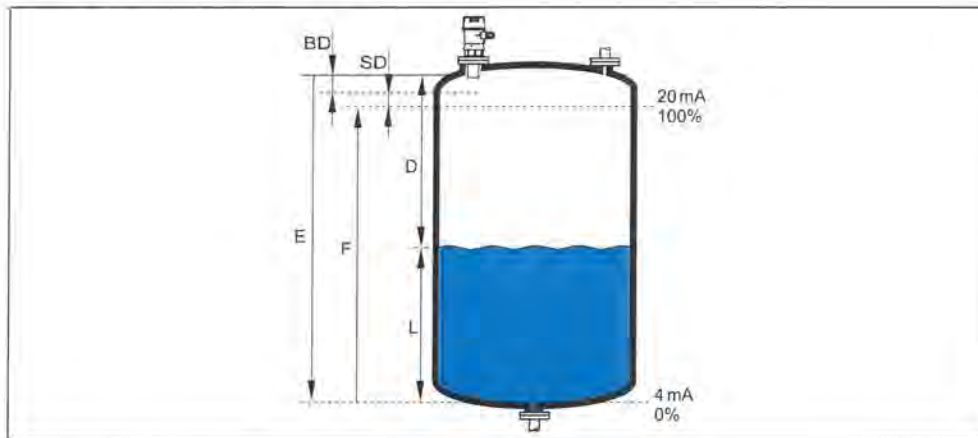
Endress+Hauser 
People for Process Automation

Inhaltsverzeichnis

Function and system design	2	Housing design	16
Measuring principle	2	Process connection, sensor material, matching layer	16
Equipment architecture	4		
Input	5	Human interface	17
Measured variable	5	Display and operating elements	17
Measuring range	5	On-site operation	19
Operating frequency	6	Remote operation	19
Output	7	Certificates and Approvals	21
Output signal	7	CE mark	21
Signal on alarm	7	Ex approval	21
Output damping	7	External standards and guidelines	21
Linearisation	7		
		Ordering information	22
Auxiliary energy	8	FMU30	22
Terminal compartment	8	Scope of delivery	22
Terminal assignment	8		
Supply voltage	9	Accessories	23
Terminals	9	Installation bracket	23
Cable entry	9	Screw in flange	23
Cable gland	9	Canilever	25
Power consumption	9	Mounting Frame	26
Current consumption	9	Wall Bracket	26
		Commubox FXA291	27
		ToF Adapter FXA291	27
Performance characteristics	10		
Reaction time	10	Supplementary documentation	27
Reference operating conditions	10	Operating manual	27
Measured value resolution	10	Description of device functions	27
Pulse frequency	10	Short instructions	27
Measuring error	10		
Influence of the vapor pressure	10		
Installation conditions	11		
Installation variants	11		
Installation conditions for level measurements	12		
Installation in narrow shafts	12		
Installation conditions for flow measurements	13		
Blocking distance, nozzle installation	14		
Ambient conditions	15		
Ambient temperature	15		
Storage temperature	15		
Resistance to alternating temperature cycles	15		
Climate class	15		
Ingress protection	15		
Vibration resistance	15		
Electromagnetic compatibility (EMC)	15		
Process conditions	15		
Process temperature	15		
Process pressure	15		
Mechanical construction	16		
Design; dimensions	16		
Weight	16		

Function and system design

Measuring principle



E: Empty distance
F: Span (full distance)
D: Distance from sensor membrane - product surface
L: Level
BD: Blocking distance
SD: Safety distance

Sensor	BD	Max. range fluids	Max. range bulk materials
1 1/2"	0.25 m (0.8 ft)	5 m (16 ft)	2 m (6.6 ft)
2"	0.35 m (1.1 ft)	8 m (26 ft)	3.5 m (11 ft)

Time-of-flight method

The sensor of the instrument transmits ultrasonic pulses in the direction of the product surface. There, they are reflected back and received by the sensor. The instrument measures the time t between pulse transmission and reception. The instrument uses the time t (and the velocity of sound c) to calculate the distance D between the sensor membrane and the product surface:

$$D = c \cdot t / 2$$

As the device knows the empty distance E from a user entry, it can calculate the level as follows:

$$L = E - D$$

An integrated temperature sensor compensates for changes in the velocity of sound caused by temperature changes.

Interference echo suppression

The interference echo suppression feature on the instrument ensures that interference echos (e.g. from edges, welded joints and installations) are not interpreted as a level echo.

Calibration

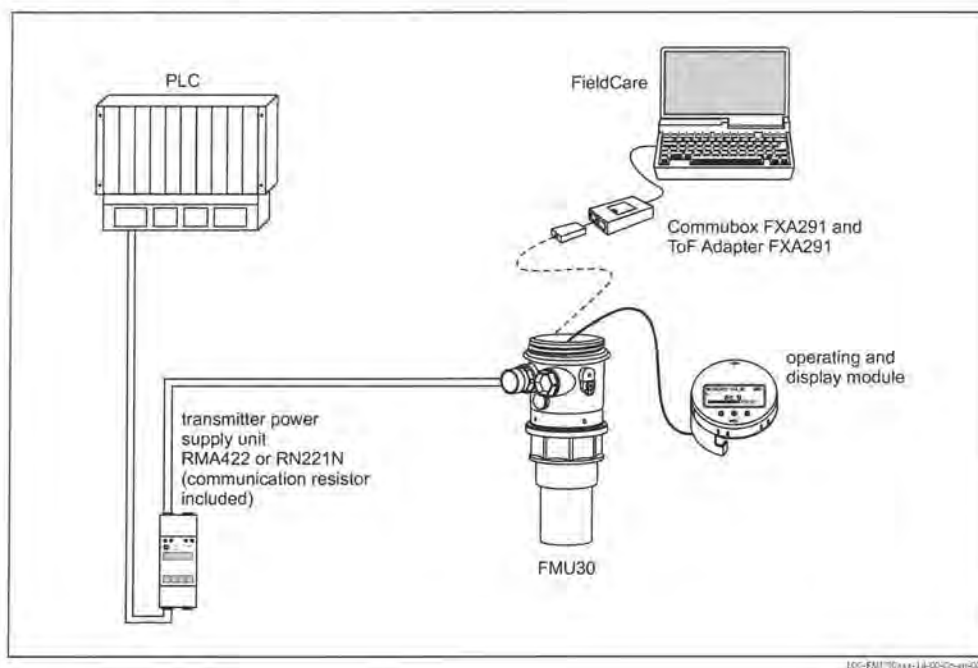
Enter the empty distance E and the span F to calibrate the device.

Blocking distance

Span F may not extend into the blocking distance BD . Level echos from the blocking distance cannot be evaluated due to the transient characteristics of the sensor.

Equipment architecture

The complete measuring system consists of:

**On-site operation**

- with display and operating module
- with a PC, Commubox FXA291 + ToF Adapter FXA291 and the operating software FieldCare

Input

Measured variable

The distance D between the sensor membrane and the product surface is measured, see also figure → 3.

Using the linearisation function, the device uses D to calculate:

- level L in any units
- volume V in any units
- flow Q across measuring weirs or open channels in any units

Measuring range

The measuring range is limited by the range of a sensor. The sensor range is, in turn, dependent on the operating conditions. To estimate the actual range, proceed as follows (see also the calculation example in the diagram):

1. Determine which of the influences shown in the following table are appropriate for your process.
2. Add the corresponding attenuation values.
3. From the total attenuation, use the diagram to calculate the range.

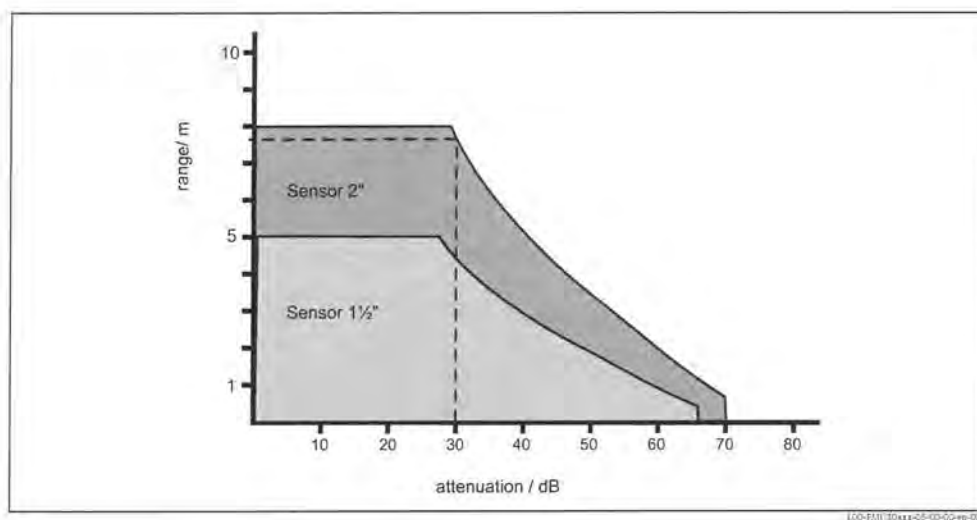
Fluid surface	Attenuation
Calm	0 dB
Waves	5 to 10 dB
Strong turbulence (e.g. stirrers)	10 to 20 dB
Foaming	Ask Endress+Hauser

Bulk material surface	Attenuation
Hard, rough (e.g. rubble)	40 dB
Soft (e.g. peat, dust-covered clinker)	40 to 60 dB

Dust	Attenuation
No dust formation	0 dB
Little dust formation	5 dB
Heavy dust formation	5 to 20 dB

Filling curtain in detection range	Attenuation
None	0 dB
Small quantities	5 to 10 dB
Large quantities	10 to 40 dB

Temperature difference between sensor and product surface	Attenuation
to 20 °C (68 °F)	0 dB
to 40 °C (104 °F)	5 to 10 dB
to 60 °C (140 °F)	10 to 15 dB

**Example**

- strong turbulence surface approx. 20 dB
 - no dust formation 0 dB
 - Filling curtain in detection range 10 dB
 - Temperature diff. < 20°C 0 dB
- approx. 30 dB => range approx. 7.8 m (26 ft) for FMU30 2" sensor

Operating frequency

1½" sensor	2" sensor
approx. 70 kHz	approx. 50 kHz

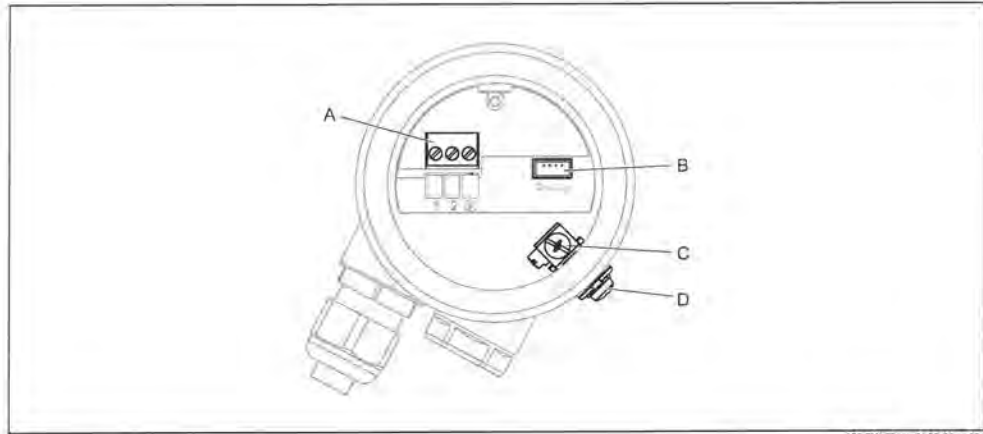
Output

Output signal	4 to 20 mA
Signal on alarm	<p>Error information can be accessed via the following interfaces:</p> <ul style="list-style-type: none"> ■ On-site display (error symbol, error code and plain text description) ■ Current output (error current configurable)
Output damping	Freely selectable, 0 to 255 s
Linearisation	<p>The linearisation function of the instrument allows conversion of the measured value into any unit of length or volume. In open channels or measuring weirs, also a flow linearisation is possible (calculation of the flow from the measured level).</p> <p>The linearisation table for calculating the volume in an horizontal cylindrical tank is preprogrammed. You can also enter any number of other tables containing up to 32 value pairs either manually or semi-automatically (by filling the vessel under controlled conditions).</p>

Auxiliary energy

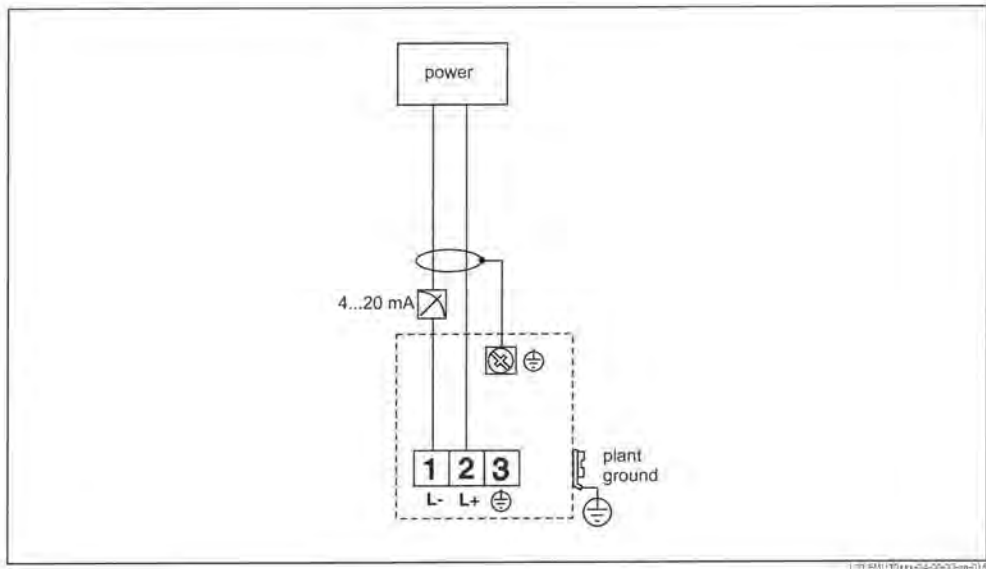
Terminal compartment

The terminals are located underneath the housing cover.



- A: terminals
- B: optional: display
- C: internal earth terminal
- D: external earth terminal

Terminal assignment



- Connect the connecting line to the screw terminals (line cross-sections of 0.25 to 2.5 mm (0.01 to 0.1 in)) in the terminal compartment.
- A standard installation cable is sufficient for the connection.
- Protective circuitry against reverse polarity, RFI and over-voltage peaks is built into the device (see also Technical Information TI241F/00/EN "EMC Test Procedures")

Supply voltage

The following values are the voltages across the terminals directly at the instrument:

Current consumption	Terminal voltage minimum	Terminal voltage maximum
4 mA	14 V	35 V
20 mA	8 V	35 V

Terminals

Cable cross-section: 0.25 to 2.5 mm² (20 to 14 AWG)

Cable entry

G ½ or ½ NPT

Cable gland

M20x1.5 (recommended cable diameter 6 to 10 mm (0.24 to 0.39 in))

Power consumption

51 mW to 800 mW

Current consumption

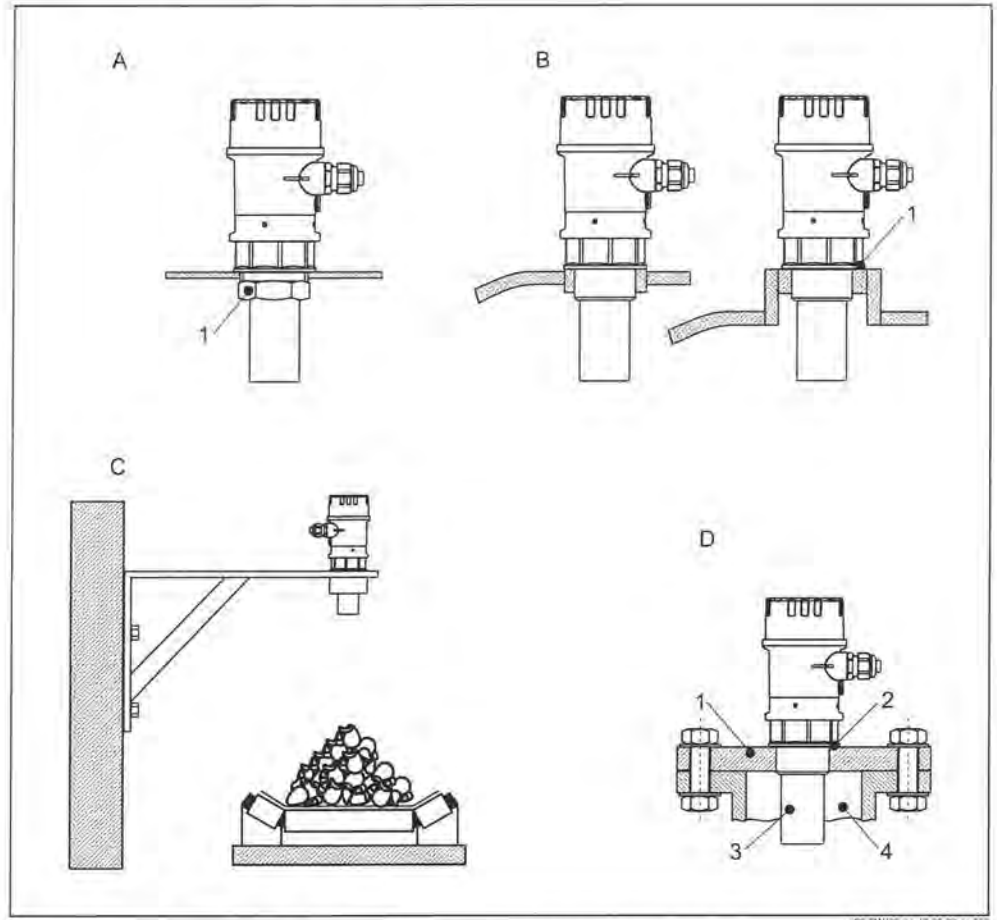
3.6 to 22 mA

Performance characteristics

Reaction time	The reaction time depends on the parameter settings. The minimum value is: min. 2 s
Reference operating conditions	<ul style="list-style-type: none"> ■ Temperature = +20 °C (68 °F) ■ Pressure = 1013 mbar abs. (15 psi abs.) ■ Humidity = 50 % ■ Ideal reflective surface (e.g. calm, smooth fluid surface) ■ No interference reflections within signal beam ■ Set application parameters: <ul style="list-style-type: none"> – Tank shape = flat ceiling – Medium property = liquid – process conditions = calm surface
Measured value resolution	1 mm (0.04 in)
Pulse frequency	max. 0.5 Hz The exact values are dependent on the type of device and the parameter settings.
Measuring error	Typical specifications for reference operating conditions (include linearity, repeatability, and hysteresis): $\pm 3 \text{ mm } (\pm 0.12 \text{ in})$ or 0.2 % of set measuring distance (empty calibration) ¹ ¹ whichever is greater
Influence of the vapor pressure	The vapor pressure at 20 °C (68 °F) gives a hint on the accuracy of the ultrasonic level measurement. If the vapor pressure at 20 °C (68 °F) is below 50 mbar (1 psi), ultrasonic level measurement is possible with a very high accuracy. This is valid for water, aqueous solutions, water-solid-solutions, dilute acids (hydrochloric acid, sulfuric acid, ...), dilute bases (caustic soda, ...), oils, greases, slurries, pastes, ... High vapor pressures or outgassing media (ethanol, acetone, ammonia, ...) can influence the accuracy. If conditions like these are present, please contact the Endress+Hauser support.

Installation conditions

Installation variants



A: Installation with counter nut (1: counter nut (PC) supplied for G1½ and G2 instruments)

B: Installation with sleeve (1: sealing ring (EPDM) supplied)

C: Installation with installation bracket

D: Installation with screw in flange

1: screw in flange

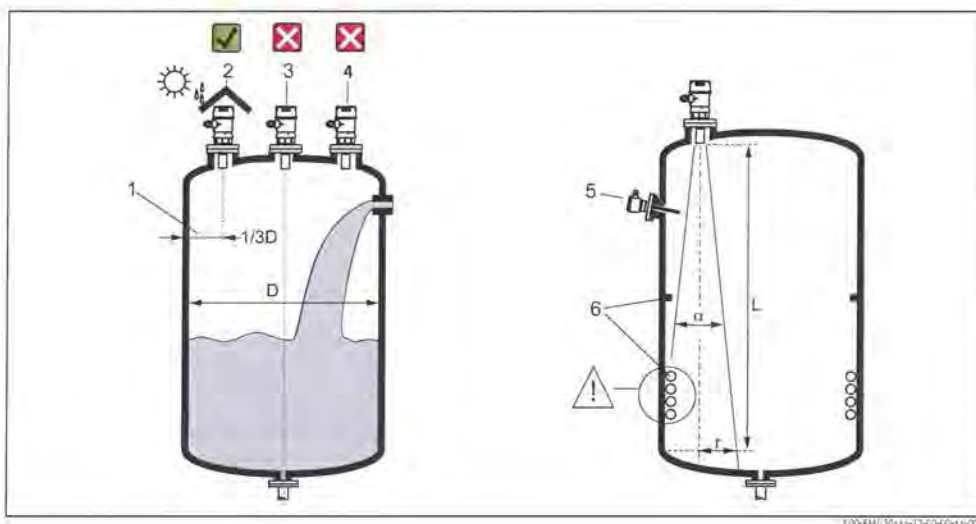
2: sealing ring (EPDM) supplied

3: sensor

4: nozzle

For installation bracket or screw in flange → 23, "Accessories".

Installation conditions for level measurements



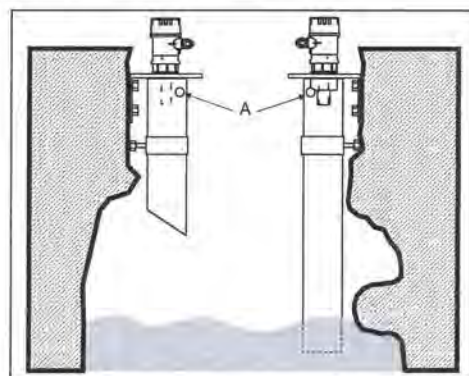
- Do not install the sensor in the middle of the tank (3). We recommend leaving a distance between the sensor and the tank wall (1) measuring $1/3D$ of the tank diameter.
- Protect the device against direct sun or rain (2).
- Avoid measurements through the filling curtain (4).
- For solid application where bulk solid cones appear, align the sensor membrane perpendicular to the surface.
- Make sure that equipment (5) such as limit switches, temperature sensors, etc. are not located within the emitting angle α . In particular, symmetrical equipment (6) such as heating coils, baffles etc. can influence measurement.
- Never install two ultrasonic measuring devices in a tank, as the two signals may affect each other.
- To estimate the detection range, use the 3 dB emitting angle α .

Sensor	α	L_{max}	r_{max}
1 1/2"	11°	5 m (16 ft)	0,48 m (1.6 ft)
2"	11°	8 m (26 ft)	0.77 m (2.5 ft)

Installation in narrow shafts

In narrow shafts with strong interference echoes, we recommend using an ultrasound guide pipe (e.g. PE or PVC wastewater pipe) with a minimum diameter of 100 mm (3.94 in).

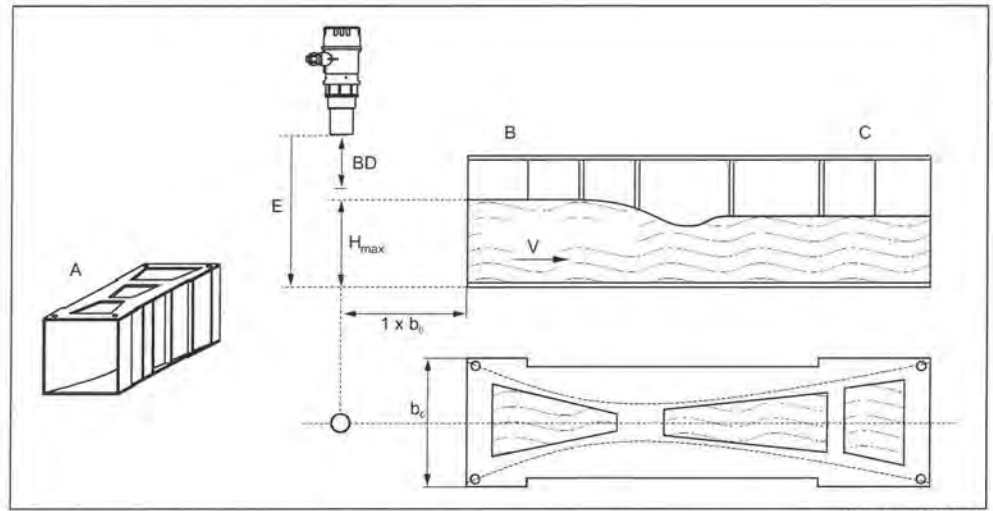
Make sure that the pipe is not soiled by accumulated dirt. If necessary, clean the pipe at regular intervals.



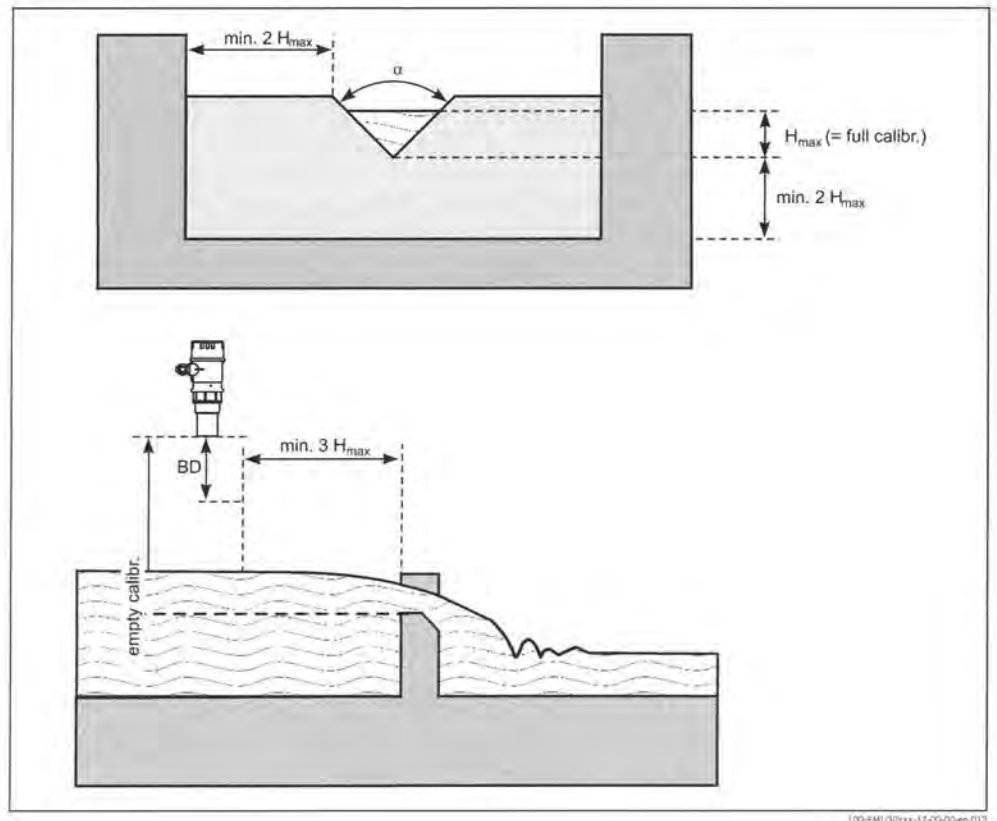
A: venting hole

Installation conditions for flow measurements

- Install the instrument at the inflow side (B), as close above the maximum water level H_{\max} as possible (take into account the blocking distance BD).
- Position the instrument in the middle of the channel or weir.
- Align the sensor membrane parallel to the water surface.
- Keep to the installation distance of the channel or weir.

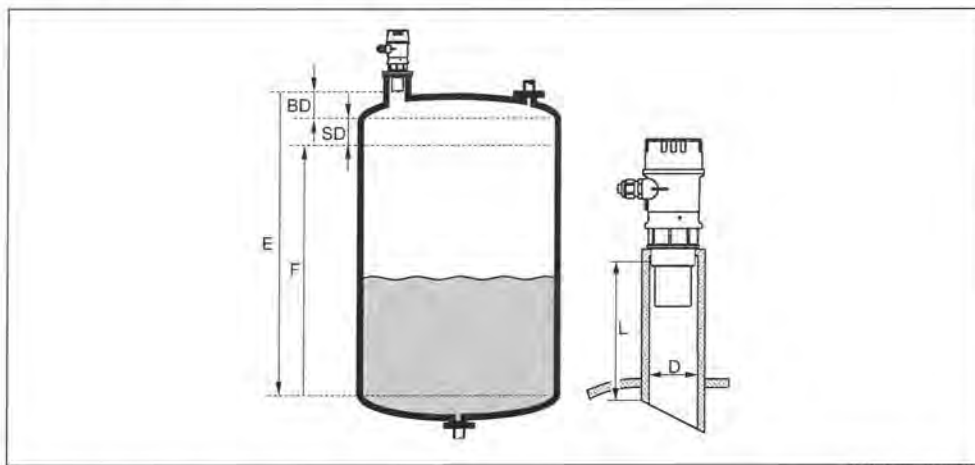
Example: Khafagi-Venturi flume

A: Khafagi-Venturi flume; B: inflow; C: outflow; E: empty calibration; V: direction of flow

Example: Triangular weir

**Blocking distance,
nozzle installation**

Install the instrument at a height so that the blocking distance BD is not undershot, even at maximum fill level. Use a pipe nozzle if you cannot maintain the blocking distance in any other way. The interior of the nozzle must be smooth and may not contain any edges or welded joints. In particular, there should be no burr on the inside of the tank side nozzle end. Note the specified limits for nozzle diameter and length. To minimise disturbing factors, we recommend an angled socket edge (ideally 45°).



BD: blocking distance; SD: safety distance; E: empty calibration; F: full calibration (span); D: nozzle diameter; L: nozzle length

Nozzle diameter	Maximum nozzle length mm (in)	
	1 1/2" sensor	2" sensor
DN50/2"	80 (3.15)	
DN80/3"	240 (9.45)	240 (9.45)
DN100/4"	300 (11.8)	300 (11.8)
DN150/6"	400 (15.7)	400 (15.7)
DN200/8"	400 (15.7)	400 (15.7)
DN250/10"	400 (15.7)	400 (15.7)
DN300/12"	400 (15.7)	400 (15.7)
Emitting angle α	11°	11°
Blocking distance m (ft)	0.25 (0.8)	0.35 (1.1)
Max. range m (ft) in liquids	5 (16)	8 (26)
Max. range m (ft) in solids	2 (6.6)	3.5 (11)

**Caution!**

If the blocking distance is undershot, it may cause device malfunction.

**Note!**

In order to notice if the level approaches the blocking distance, you can specify a safety distance (SD). If the level is within this safety distance, the instrument outputs a warning or alarm message.

Ambient conditions

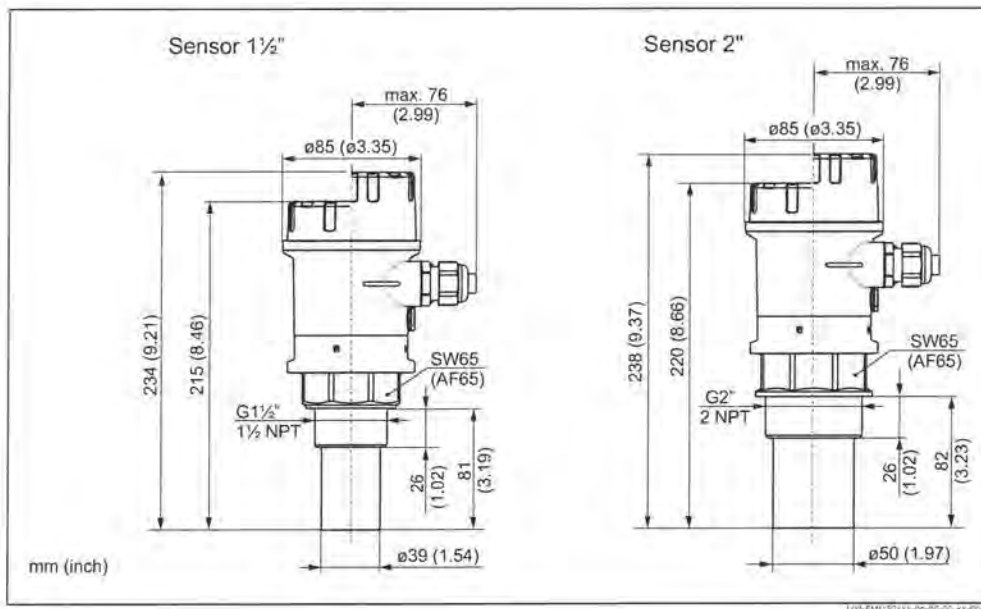
Ambient temperature	-20 °C to +60 °C (-4 °F to 140 °F) If the device is operated outdoors, protect the device against direct sun or rain.
Storage temperature	-40 °C to +80 °C (-40 °F to 176 °F)
Resistance to alternating temperature cycles	to DIN EN 60068-2-14; Nb test : +60°C/-20°C (140 °F/-4 °F), 0.5K/min, 100cycles
Climate class	DIN EN 60068-2-38 (Test Z/AD) DIN/IEC 68 T2-30Db
Ingress protection	<ul style="list-style-type: none"> ■ With closed housing, tested according to <ul style="list-style-type: none"> – IP 68 – IP 66 ■ With open housing: IP 20 (also ingress protection of the display)
Vibration resistance	DIN EN 60068-2-64 / IEC 68-2-64: 20 to 2000 Hz, 1 (m/s ²)/Hz; 3 x 100 min
Electromagnetic compatibility (EMC)	<p>Electromagnetic compatibility to EN 61326. For details refer to the declaration of conformity.</p> <p>Influence of EMC < 1 % FS</p>

Process conditions

Process temperature	-20°C to +60°C (-4 °F to 140 °F) A temperature sensor is integrated in the sensor for correction of the temperature-dependent time-of-flight.
Process pressure	0.7 bar to 3 bar abs. (10,15 psi to 43,5 psi)

Mechanical construction

Design; dimensions



Weight

1 1/2" sensor	2" sensor
approx. 0.75 kg (1.65 lbs)	approx. 0.8 kg (1.76 lbs)

Housing design

Types of housings

F16 housing

Material

- Housing: PBT-FR
- Cover: PBT/PA

Cover

- for version without on-site display (low, grey)
- for version with on-site display (high, transparent)

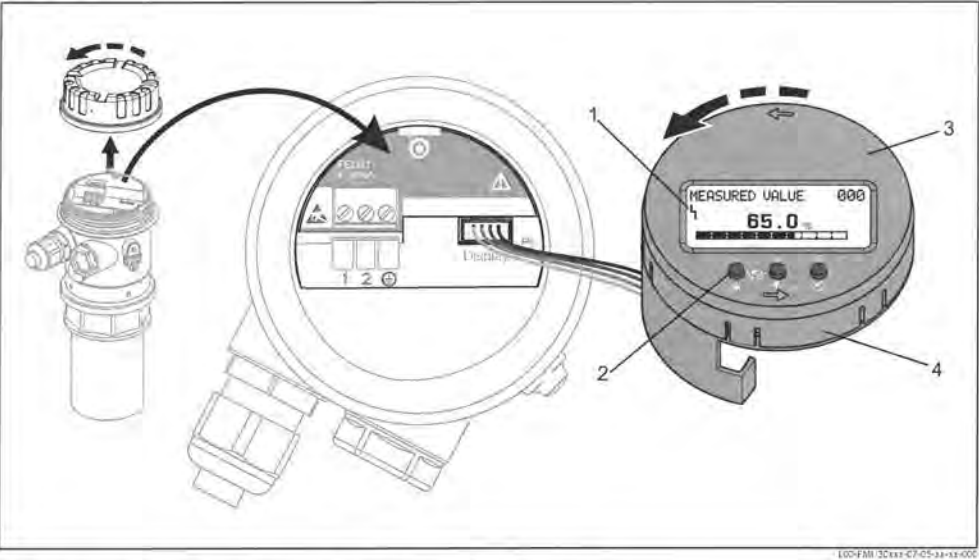
Process connection, sensor material, matching layer

Sensor	Process connection	Material in contact with process
1 1/2"	<ul style="list-style-type: none"> ■ Thread G 1 1/2" ■ Thread NPT 1 1/2" - 11.5 	Sensor: PP Matching Layer EPDM
2"	<ul style="list-style-type: none"> ■ Thread 2" ■ Thread NPT 2" - 11.5 	Sensor: PP Matching Layer EPDM

Human interface

Display and operating elements

The LCD module for display and operation is located beneath the housing cover. Open the cover to operate the device.



1: Display symbol; 2: Function keys; 3: Display (rotatable); 4: Plug-in module

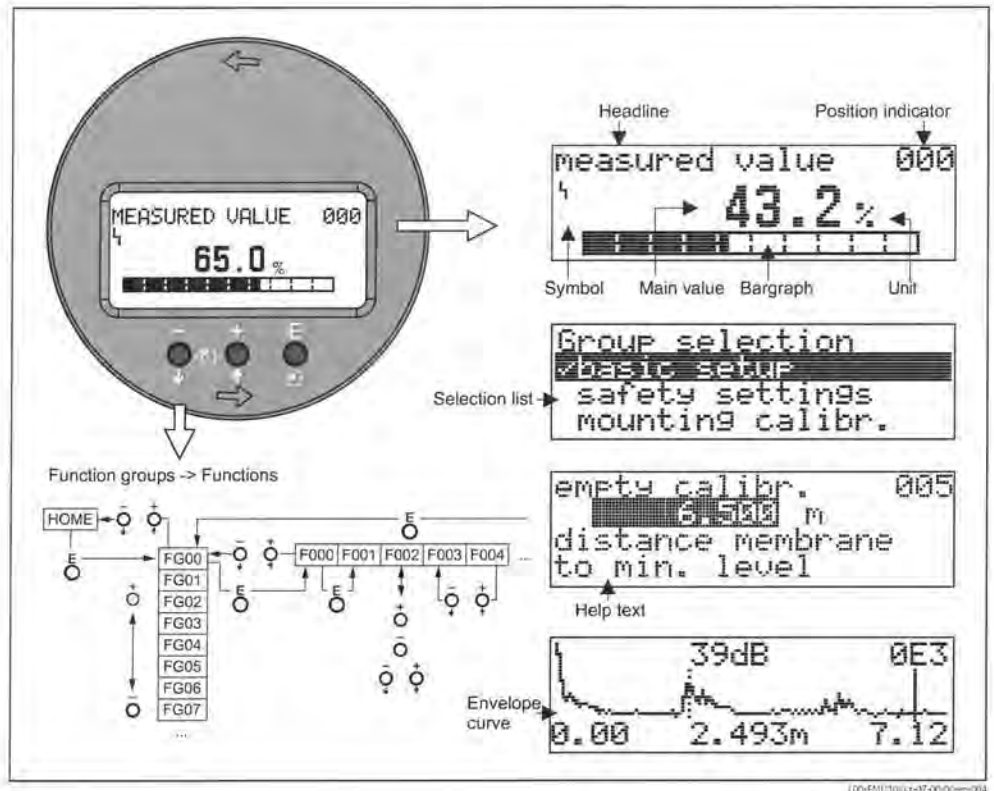
Symbol in display			
	continuous	flashing	
Meaning	Alarm	Warning	Security Locking

Function of the keys

Key(s) (The keys to press are displayed in grey.)	Meaning
	Navigate upwards in the selection list Edit numeric value within a function
	Navigate downwards in the selection list Edit numeric value within a function
	Navigate to the left within a function group
	Navigate to the right within a function group, confirmation.
	Contrast settings of the LCD
	Hardware lock / unlock After a hardware lock, an operation of the instrument via display or communication is not possible! The hardware can only be unlocked via the display. An unlock parameter must be entered to do so.

On-site operation**Operation**

The LC-Display allows configuration via 3 keys directly at the instrument. All device functions can be set through a menu system. The menu consists of function groups and functions. Within a function, application parameters can be read or adjusted. The user is guided through a complete configuration procedure.

**Remote operation****Operation with FieldCare**

FieldCare is Endress+Hauser's FDT based Plant Asset Management Tool. It can configure all intelligent field devices in your plant and supports you in managing them. By using status information, it also provides a simple but effective means of checking their health.

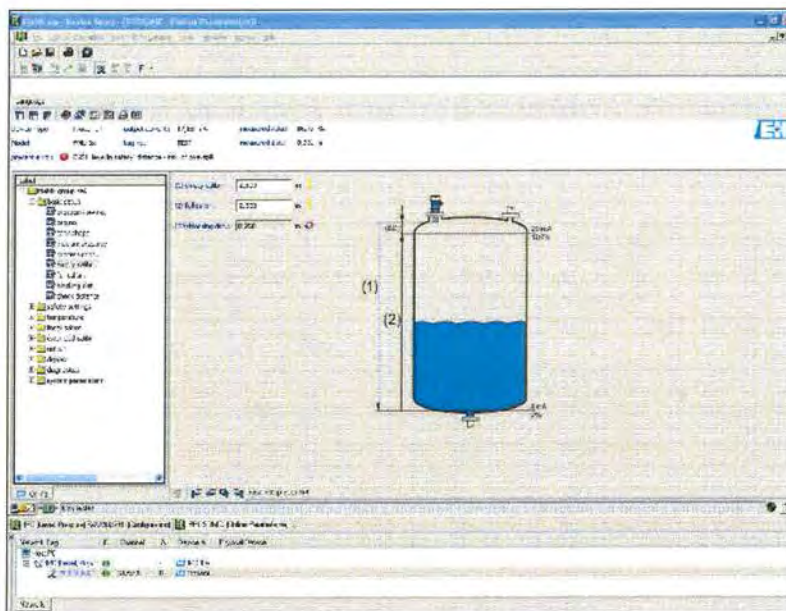
- Supports Ethernet, HART, PROFIBUS PA, FOUNDATION Fieldbus etc.
- Operates all Endress+Hauser devices
- Operates all third-party actuators, I/O systems and sensors supporting the FDT standard
- Ensures full functionality for all devices with DTMs
- Offers generic profile operation for any third-party fieldbus device that does not have a vendor DTM

Connection for FMU30:

- Commubox FXA291 and ToF adapter FXA291 (available as accessory)

Using the following functions:

- Signal analysis via envelope curve
- Linearisation table (graphically supported creation, editing, importing and exporting)
- Loading and saving of instrument data (Upload/Download)
- Documentation of measuring point

Menu-guided commissioning:*Signal analysis via envelope curve:*

Certificates and Approvals

CE mark	The measuring system meets the legal requirements of the EC-guidelines. Endress+Hauser confirms the instrument passing the required tests by attaching the CE-mark.
Ex approval	The available certificates are listed in the ordering information. Note the associated safety instructions (XA) and control or installation drawings (ZD).
External standards and guidelines	<p>EN 60529 Protection class of housing (IP-code)</p> <p>EN 61326 series EMC product family standard for electrical equipment for measurement, control and laboratory use.</p> <p>NAMUR Standards committee for measurement and control in the chemical industry</p>

Ordering information

FMU30

Versions that mutually exclude one another are not marked.

10	Approval:	
	AA	Non-hazardous area
	BB	ATEX II 1/2G Ex ia IIC T6
	IB	IEC Ex zone 0/1, Ex ia IIC T6 Ga/Gb
	NB	NEPSI zone 0/1, Ex ia IIC T6 Ga/Gb
	TA	TIIS Ex ia IIC T4
	8A	CEC/NEC General Purpose
	8C	CEC/NEC IS CL.I Div. I Gr.A-D
	99	Special version
20	Display; Operating:	
	G	W/o; only via Commubox+ToF Adapter FXA291
	H	Envelope curve display on site; push button
	Y	Special version
30	Electrical Connection:	
	E	Gland M20, IP68
	F	Thread G1/2, IP68
	G	Thread NPT1/2, IP68
	Y	Special version
40	Sensor; Max Range; Blocking Distance:	
	AA	1-1/2"; 5m liquid/2m solid; 0.25m
	AB	2"; 8m liquid/3.5m solid; 0.35m
	YY	Special version
50	Process Connection:	
	GGF	Thread ISO228 G1-1/2, PP
	GHF	Thread ISO228 G2, PP
	RGF	Thread ANSI MNPT1-1/2, PP
	RHF	Thread ANSI MNPT2, PP
	YYY	Special version
620	Accessory Enclosed:	
	RA	UNI flange 2"/DN50/50, PP max 3bar abs/44psia, suitable for 2" 150lbs/DN50 PN16/10K 50
	RB	UNI flange 2"/DN50/50, PVDF max 3bar abs/44psia, suitable for 2" 150lbs/DN50 PN16/10K 50
	RC	UNI flange 2"/DN50/50, 316L max 3bar abs/44psia, suitable for 2" 150lbs/DN50 PN16/10K 50
	RD	UNI flange 3"/DN80/80, PP max 3bar abs/44psia, suitable for 3" 150lbs/DN80 PN16/10K 80
	RE	UNI flange 3"/DN80/80, PVDF max 3bar abs/44psia, suitable for 3" 150lbs/DN80 PN16/10K 80
	RF	UNI flange 3"/DN80/80, 316L max 3bar abs/44psia, suitable for 3" 150lbs/DN80 PN16/10K 80
	RG	UNI flange 4"/DN100/100, PP max 3bar abs/44psia, suitable for 4" 150lbs/DN100 PN16/10K 100
	RH	UNI flange 4"/DN100/100, PVDF max 3bar abs/44psia, suitable for 4" 150lbs/DN100 PN16/10K 100
	RI	UNI flange 4"/DN100/100, 316L max 3bar abs/44psia, suitable for 4" 150lbs/DN100 PN16/10K 100
	R9	Special version
895	Marking:	
	Z1	Tagging (TAG), see additional spec.

You can enter the versions for the specific feature in the following table. The versions entered make up the complete order code. Options which are mutually exclusive are not marked.

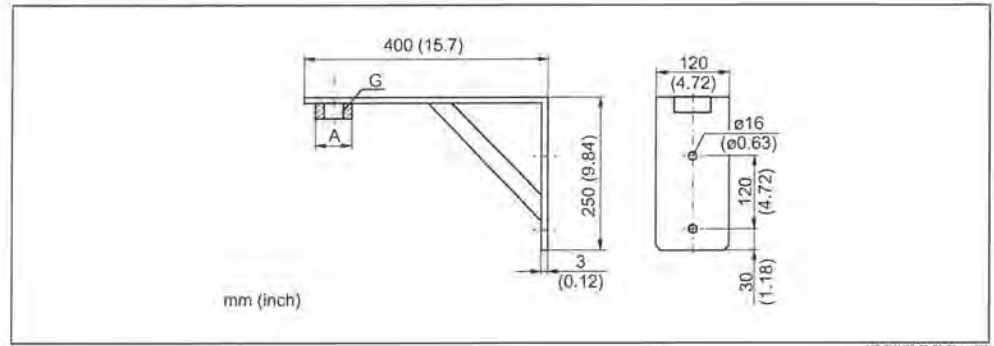
	10	20	30	40	50	620	895
FMU30 -							

Scope of delivery

- Instrument according to the version ordered
- Short instructions KA1054F; additional documentations on the supplied CD-ROM
- For certified instrument versions: Safety Instructions, Control- or Installation drawings
- Counter nut (PC): option 50, versions GGF/GHF, → 22 "Ordering information"
- Sealing ring (EPDM): option 50 → 22 "Ordering information"
- For gland M20x1.5: 1 cable gland for 2-wire instruments
The cable gland is mounted on delivery.

Accessories

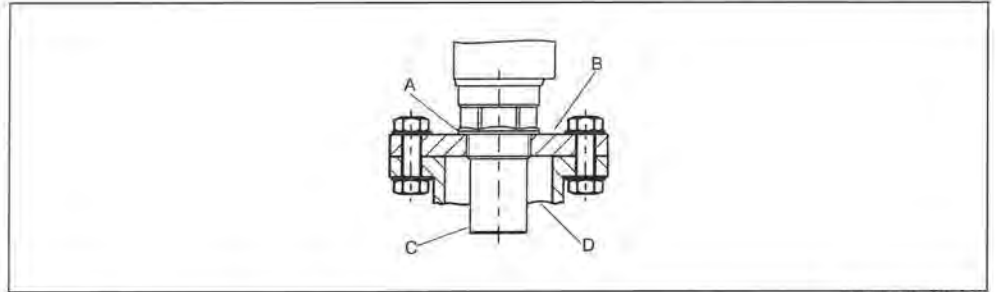
Installation bracket



- G1½: Order No. 942669-0000
- G2: Order No. 942669-0001

suited for NPT 1½" and 2" as well

Screw in flange



A: sealing ring EPDM (supplied); **B:** screw in flange; **C:** sensor; **D:** nozzle

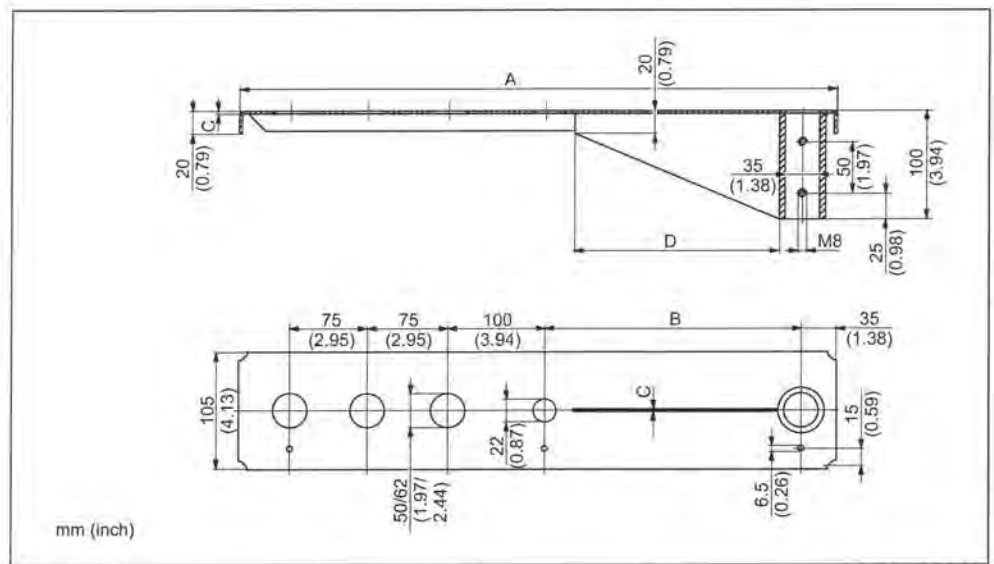
Screw in flange FAX50

15	Material:	
	BR1	DN50 PN10/16 A, steel flange EN1092-1
	BS1	DN80 PN10/16 A, steel flange EN1092-1
	BT1	DN100 PN10/16 A, steel flange EN1092-1
	JF1	2" 150lbs FF, steel flange ANSI B16.5
	JG1	3" 150lbs FF, steel flange ANSI B16.5
	JH1	4" 150lbs FF, steel flange ANSI B16.5
	JK2	8" 150lbs FF, PP max 3bar abs/44psia flange ANSI B16.5
	XIF	UNI flange 2"/DN50/50, PVDF max 3bar abs/44psia, suitable for 2" 150lbs/DN50 PN16/10K 50
	XIG	UNI flange 2"/DN50/50, PP max 3bar abs/44psia, suitable for 2" 150lbs/DN50 PN16/10K 50
	XIJ	UNI flange 2"/DN50/50, 316L max 3bar abs/44psia, suitable for 2" 150lbs/DN50 PN16/10K 50
	XJF	UNI flange 3"/DN80/80, PVDF max 3bar abs/44psia, suitable for 3" 150lbs/DN80 PN16/10K 80
	XJG	UNI flange 3"/DN80/80, PP max 3bar abs/44psia, suitable for 3" 150lbs/DN80 PN16/10K 80
	XJJ	UNI flange 3"/DN80/80, 316L max 3bar abs/44psia, suitable for 3" 150lbs/DN80 PN16/10K 80
	XKF	UNI flange 4"/DN100/100, PVDF max 3bar abs/44psia, suitable for 4" 150lbs/DN100 PN16/10K 100
	XKG	UNI flange 4"/DN100/100, PP max 3bar abs/44psia, suitable for 4" 150lbs/DN100 PN16/10K 100
	XKJ	UNI flange 4"/DN100/100, 316L max 3bar abs/44psia, suitable for 4" 150lbs/DN100 PN16/10K 100
	XLF	UNI flange 6"/DN150/150, PVDF max 3bar abs/44psia, suitable for 6" 150lbs/DN150 PN16/10K 150
	XLG	UNI flange 6"/DN150/150, PP max 3bar abs/44psia, suitable for 6" 150lbs/DN150 PN16/10K 150
	XLJ	UNI flange 6"/DN150/150, 316L max 3bar abs/44psia, suitable for 6" 150lbs/DN150 PN16/10K 150
	XMG	UNI flange DN200/200, PP max 3bar abs/44psia, suitable for DN200 PN16/10K 200
	XNG	UNI flange DN250/250, PP max 3bar abs/44psia, suitable for DN250 PN16/10K 250
	YYY	Special version
20	Sensor Connection:	
	A	Thread ISO228 G3/4
	B	Thread ISO228 G1
	C	Thread ISO228 G1-1/2
	D	Thread ISO228 G2
	E	Thread ANSI NPT3/4
	F	Thread ANSI NPT1
	G	Thread ANSI NPT1-1/2
	H	Thread ANSI NPT2
	Y	Special version

The filled in options result in the complete order code.

	15	20
FAX50 -		

Cantilever



A	B	C	D	Sensor	Material	Order Code
585 (23)	250 (9.84)	2 (0.08)	200 (7.87)	1½"	316Ti/1.4571	52014132
					galv. steel	52014131
				2"	316Ti/1.4571	52014136
					galv. steel	52014135
1085 (42.7)	750 (29.5)	3 (0.12)	300 (11.8)	1½"	316Ti/1.4571	52014134
					galv. steel	52014133
				2"	316Ti/1.4571	52014138
					galv. steel	52014137

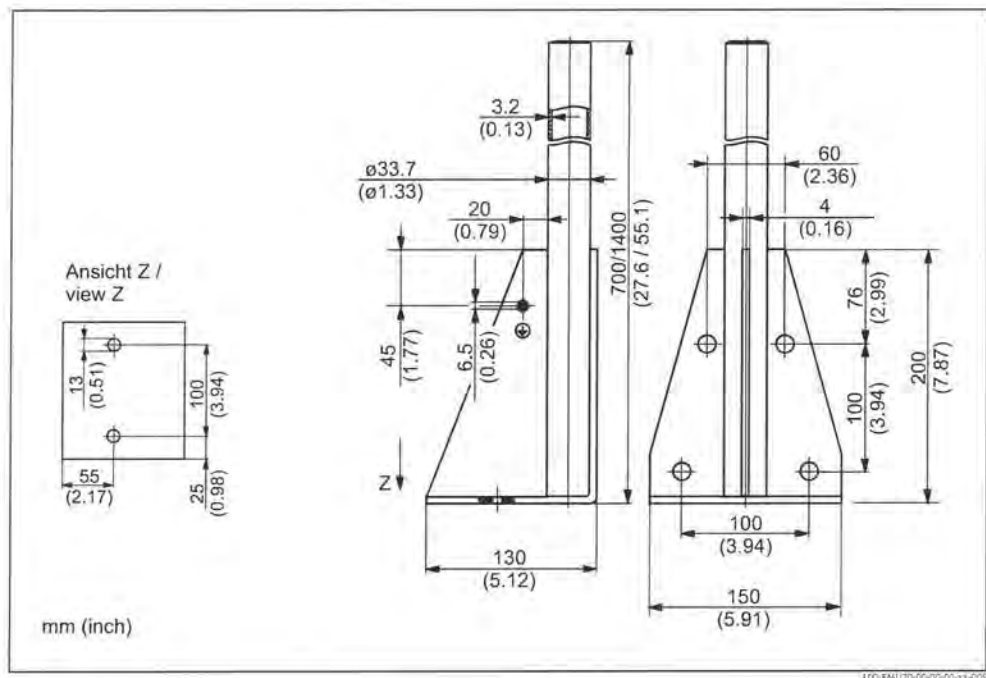
mm (in)

- The 50 mm (2.17 in) or 62 mm (2.44 in) orifices serve for the mounting of the 1½" or 2" sensor, respectively.
- The 22 mm (0.87 in) orifice may be used for an additional sensor.

For the mounting of the cantilever can be used:

- mounting frame, → * 26
- wall bracket, → * 26

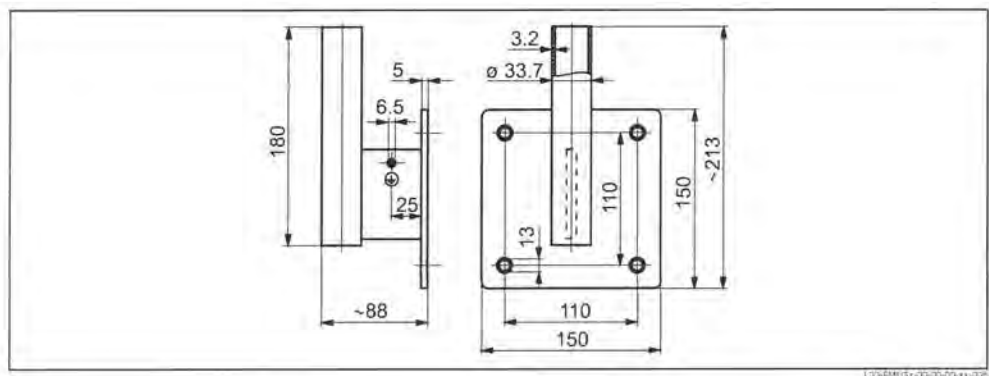
Mounting Frame



Height	Material	Order Code
700 (27.6)	galv. steel	919791-0000
700 (27.6)	1.4301 (AISI 304)	919791-0001
1400 (55.1)	galv. steel	919791-0002
1400 (55.1)	1.4301 (AISI 304)	919791-0003

mm (in)

Wall Bracket



Material	Order Code
galv. steel	919792-0000
316Ti/1.4571	919792-0001

Commubox FXA291	<p>The Commubox FXA291 connects Endress+Hauser field instruments with CDI interface (= Endress+Hauser Common Data Interface) to the USB interface of a personal computer or a notebook. For details refer to TI405C/07/EN.</p> <p>Note! For the FMU30 you need the "ToF Adapter FXA291" as an additional accessory.</p>
ToF Adapter FXA291	<p>The ToF Adapter FXA291 connects the Commubox FXA291 via the USB interface of a personal computer or a notebook to the FMU30.</p> <p>For details refer to KA271F/00/A2.</p>

Supplementary documentation

Operating manual	<p>BA387F</p> <p>This instruction describe the installation and first commissioning of the instrument. From the operating menu, all functions are included, which are required for standard measurement tasks. Additional functions are not contained in the manual.</p> <p>The documentation can be found on the supplied documentation CD. The documentation is also available via the Internet → siehe: www.endress.com → Download.</p>
Description of device functions	<p>BA388F</p> <p>This contains a detailed description of all the functions of the instrument and is valid for all communication variants.</p> <p>The documentation can be found on the supplied documentation CD. The documentation is also available via the Internet → www.endress.com → Download.</p>
Short instructions	<p>KA1054F</p> <p>is for rapid commissioning of the device. The instructions are attached to the device. The documentation can be found on the supplied documentation CD. The documentation is also available via the Internet → www.endress.com → Download.</p> <p>KA290F</p> <p>can be found under the device housing cover.</p> <p>The most important menu functions are summarised on this sheet. It is intended primarily as a memory jogger for users who are familiar with the operating concept of Endress+Hauser time-of-flight instruments.</p>

Instruments International

Endress+Hauser
Instruments International AG
Kaegenstrasse 2
4153 Reinach
Switzerland

Tel. +41 61 715 81 00
Fax +41 61 715 25 00
www.endress.com
info@ii.endress.com

Endress+Hauser 
People for Process Automation

TI440F/00/EN/12.09
71105940
FM+SGML 6.0 ProMoDo



4

MOTOR/GEARBOX DETAILS

- Rossi Gearmotor

Model: MR 4I 100



UT.D 150 rev.0

01-06 / 0 - IT EN

INSTALLATION AND MAINTENANCE INSTRUCTIONS FOR ASYNCHRONOUS THREE AND SINGLE-PHASE MOTORS: STANDARD HF (HFM), BRAKE F0, HFF, HFZ, HFV (HFVM), FLAT EXTRUDED HPE (HPEM), HPEV (HPEVM) AND FOR ROLLER WAYS RN, RS

1. General safety instructions



Danger: electric rotating machines present dangerous parts: when operating they have live and rotating components and surfaces with temperatures higher than 50 °C.



Motor should not be put into service before it has been incorporated on a machine which conforms to 98/37/EEC directive.

An incorrect installation, an improper use, the removing or disconnection of protection devices, the lack of inspections and maintenance, the inadequate connections may cause several personal injury or property damage. Therefore motor must be moved, installed, put into service, handled, controlled, serviced and repaired **exclusively by responsible qualified personnel** (definition to IEC 364).

It is recommended to pay attention to following instructions, to the instructions relevant to the system, to all existing safety laws and standards concerning correct installation.

May be necessary additional information in case of motor in non-standard design, please consult the manufacturer.

Motors of these instructions are suitable for installations in industrial areas; **additional protection measures**, if necessary for other applications, must be adopted and assured by the person responsible for the installation.

When working on electric machine, machine must be stopped and disconnected from the power line (including auxiliary equipment). If there are electric protections, avoid any possibility of unexpected restarting, paying attention to specific recommendations on equipment application. In single-phase motors, running capacitor can remain temporarily charged keeping live relevant terminals even after motor stop.

For motor HPE series: **it is Buyer's responsibility to verify always the suitability of motor (blade holding kit or collet chuck shaft end, if any, which are not conceived for a specific application) and relevant correspondence to safety standards, basing on his own application specifications** (machining and material type, tool specifications, machine design, duty cycle, position of the operator, etc.).

Compliance with «Low voltage» 73/23/EEC European Directive (modified by directive 93/68): motors meet the requirements of this directive and are therefore CE marked on name plate.

2. Operating conditions

Motors, foreseen for applications in ambient temperature $-15 \div +40^{\circ}\text{C}$, maximum altitude 1000 m according to CEI EN 60034-1 standards, can be used also at ambient temperature with peaks of -20°C and $+50^{\circ}\text{C}$.

Motor operation with independent cooling fan is allowed only when the fan is running.

Not allowed running conditions: application in aggressive environments having explosion danger, etc.

3. Installation: general directions

On receipt verify that motor corresponds to the ordered one and it has not been damaged during the transport; in case of damages, contest them immediately to the courier and avoid to put into service damaged motors. Eyebolts on motors are suitable only for lifting the motor and no other machines fitted to it.

In case of **storing**, the environment must be clean, dry, free from vibrations ($v_{eff} \leq 0,2 \text{ mm/s}$) and corrosive agents. Always protect motor from humidity.

Insulation resistance control. Before putting into service and after long stillstanding or storing periods it is necessary to measure insulation resistance between the windings and to earth by adequate d.c. instrument (500 V). **Do not touch the terminals during and just after the measurement because of live terminals.**

Insulation resistance, measured at 25°C , winding temperature, must not be lower than 10 MΩ for new winding, than 1 MΩ for winding run for a long time. Lower values usually denote the presence of humidity in the windings; in this case let them dry.

During the **installation**, position the motor so as to allow a free passage of air (on fan side) for cooling. Avoid: any obstruction to the air-flow; heat sources near the motor that might affect the temperatures both of cooling air and of motor (for radiation); insufficient air recycle or any other factor hindering the steady heat exchange.

Motors should be protected, in case of outdoor installation, from solar radiation and extremes of weather; weather protection **becomes essential** when the motor is installed with vertical shaft and fan upwards.

The surface to which motor is fitted must be correctly dimensioned and flattened in order to allow fastening security and motor alignment with driven machine and to avoid vibrations on the motor.

For use under long overloads or jamming conditions,

Kalbar STP ST59 Pre Treatment (Screen Extractor OM Manual) General


cut-outs, electronic torque limiters or other similar devices should be fitted.

Where duty cycles involve a high number of on-load starts (or for duty cycle **S6** 60% for motor series HPE), it is advisable to utilize **thermal probes** for motor protection (fitted on the wiring); magnetothermal breaker is unsuitable since its threshold must be set higher than the motor nominal current of rating.

RS motors for roller ways are always equipped with thermistor type thermal probes: free terminals on terminal block.

For no-loads starts (or with very reduced load) and whenever it is necessary to have smooth starts, low starting currents and reduced stresses, adopt reduced voltage starting (e.g.: star-delta starting, starting autotransformer, with inverter, etc.).

After making sure that the voltage corresponds to name plate data, wire up to the electrical power supply of motor, of eventual brake and auxiliary equipments, referring to Fig. 1 ... 11, at ch. 5 and other additional indications attached to present instructions. Select cables of suitable section in order to avoid overheating and/or excessive voltage drops at motor terminals.

 Metallic parts of motors which normally are not under voltage, must be firmly connected to earth through a cable of adequate section and by using the proper terminal inside the terminal box marked for the purpose.

In order not to alter protection class, close the terminal box by positioning correctly the gasket and by tightening all fastening screws. For installations in environments with frequent water sprays, it is advisable to seal the terminal box and the cable gland.

For three-phase motors the direction of rotation is clockwise (drive-end view) if connections are according to Fig. 1. If direction of rotation is not as desired, invert two phases at the terminals; for single-phase motors follow the instructions on Fig. 2.

In case of connection or disconnection of high polarity (≥ 6 poles) motor windings, there can be dangerous voltage peaks. **Pre-arrange the proper protection (e.g. varistors or filters) on the supply line.**

Also the **use of inverters** requires some precautions relevant to voltage peaks (U_{max}) and voltage gradients (dU/dt) generated by this power supply type; the values become higher by increasing the mains voltage U_n , the motor size, the power supply cable length between inverter and motor and by worsening the inverter quality. For main voltages $U_n > 400$ V, voltage peaks $U_{max} > 1000$ V, voltage gradients $dU/dt > 1$ kV/ μ s, supply cables between inverter and motor > 30 m, it is recommended, especially in absence of proper non-standard designs on motor (see manufacturer's catalogue), to insert suitable filters between inverter and motor.

«**Blade holding kit**» mounting for HPE motor (see Fig. 11): mount the two blade holding flanges **2** (with blade in between), then the tightening nut **1** with circumferential groove to the inner side (1 groove in case of right hand thread, 2 grooves for left hand thread). Realize the nut tightening by locking the shaft through butt-end slot for setscrew wrench of 10 mm (size 50) and of 12 mm (size 63 ... 80). Be sure that the motor rotation (drive-end view) is counterclockwise for right thread and clockwise for left hand thread.

For not standard design «Collet chuck shaft end» (48) see cat. 3.

Pairings. It is recommended to machine the hole of

parts keyed onto shaft ends to $H7$ tolerance; for shaft ends having $D \geq 55$ mm, tolerance G7 is permissible provided that the load is uniform and light.

Before mounting, clean mating surface thoroughly and lubricate against seizure.

Assemble and disassemble with the aid of **jacking screws** and **pullers** taking care to avoid impacts and shocks which may **irremediably damage the bearings**.

In case of direct fitting or coupling be sure that the motor has been carefully aligned with the driven machine. If necessary, interpose a flexible or elastic coupling.

In case of V-belt drives make sure that overhang is minimum and that driven shaft is always parallel to machine shaft. V-belts should not be excessively tensioned in order to avoid excessive loads on bearings and motor shaft (for maximum loads on shaft end and relevant bearing life see manufacturer's catalogue).

Motor is dynamically balanced; in case of standardized shaft end the balancing is obtained with **half key** inserted into the shaft end and exclusively for the nominal rotation speed; in order to avoid vibrations and unbalances it is necessary that also power transmissions are balanced with half key.

Before executing a possible trial run without output elements, secure the key.

Before putting into service verify the correct tightening of electrical connections, fastening and fitting systems.

Check that eventual condensate drain holes are downwards.

For running at ambient temperature higher than $+40^\circ\text{C}$ or lower than -15°C consult us.

For **spare parts** order, always point out all name plate data.

In case of brake motor also refer to point 5.

Indications for the installation according to «Electromagnetic Compatibility (EMC)» 89/336/EEC Directive (modified by directives 92/31, 93/68). Asynchronous three-phase motors supplied from the line and running in continuous duty comply with EN 50081 and EN 50082 standards. No particular shieldings are necessary. This is also valid for the motor of independent cooling fan, if any.

In case of jogging operation, any disturbance generated by insertion devices must be limited through adequate wirings (as indicated by device manufacturer).

In case of brake motor with d.c. brake (HFF d.c., F0, HFZ, HFV and HPEV motors) rectifier-brake coil group can comply with standards EN 50081-1 (emission levels for civil environments) and EN 50082-2 (immunity for industrial environments) by connecting in parallel to the rectifier ($U \leq 400$ V c.a. $+5\%$) a capacitor, featuring: AC 440, 0,22 μ F class X1 to EN 132400.

When brake is supplied separately, brake cables must be kept separate from power cables. It is possible to keep together brake cables with other cables only if they are shielded.

Where motors are supplied by inverters it is necessary to follow the wiring instructions of the manufacturer of inverter.

In case of design with encoder: install the electronic control board as near as possible the encoder (and as far as possible from inverter, if any; if not possible, carefully shield the inverter); always use twisted pairs shielded leads connected to earth on both ends; signal cables of encoder must be separate from the

power cables (see specific instructions attached to the motor).
All above mentioned components are designed to be incorporated into equipment or complete systems and **should not be put into service before equipment or system has been made in conformity with 89/336/EEC directive.**

4. Periodical maintenance

Periodically verify (according to environment and duty) and reset, if necessary:

- motor cleaning (absence of oil, dirt and machining residuals) and free passage of cooling air;
- correct tightening of electrical connections (see Tab. 4), of fastening screws and motor mechanical pairing;
- static and live tightening conditions;
- that motor run is free from vibrations ($v_{\text{eff}} \leq 3,5 \text{ mm/s}$ for $P_n \leq 15 \text{ kW}$; $v_{\text{eff}} \leq 4,5 \text{ mm/s}$ for $P_n > 15 \text{ kW}$), and anomalous noises; in this case, verify motor fastening, paired machine balancing or bearings should be replaced.

For motor size ≥ 160 and motors with protection degree higher machined mating than IP55, surfaces on casing, endshields, covers, etc., before mounting, must be covered with a proper not hardening adhesive or with grease in order to assure motor tightening.

In case of brake motor also see point 5.

5. Brake (for brake motors)



The responsibility of the correct brake running is of the final assembler who, before putting into service, must:



- verify the correct running of brake and make sure that **braking torque satisfies** application needs, taking care to avoid dangers for persons or things;

- adjust braking torque (for HFF motor, only);
- respect connection instructions and any further recommendation contained in present instructions.

5.1 HFF motor brake (Fig. 6).

Brake connection

Standard motors are manufactured with separate brake supply.

For standard applications, in single-speed motors, it is possible to supply the brake directly from motor terminal block.

For **two-speed** motors and for those driven by **inverter** it is necessary to supply the brake separately with proper cables pre-arranged as shown in Fig. 5.

In case of d.c. brake design see Fig. 7 for RN1 rectifier connection scheme.

Braking torque adjustment

Motor is normally supplied with a braking torque set at about 0,71 times the maximum braking torque M_{max} (see Tab. 1) with a tolerance of $\pm 18\%$. For a correct application it is necessary to adjust the braking torque according to specifications of the driven machine.

For general applications it is normally advisable to set braking torque at about **two times** the nominal braking torque of motor.

Anyway, braking torque must be set between name plate values. If braking torque is set at a value less than the

minimum stated on name plate, it is possible to have inconstant brakings strongly affected by temperature, duty cycle and wear conditions. If there is a value set higher than the maximum one stated on name plate, it is possible to have missing or partial brake release with consequent vibrations and overheatings of electromagnet and also of motor and mechanical stresses affecting brake and motor life.

Braking torque is directly proportional to preload of braking springs **17** and can be changed by modifying the self-locking nuts **44** making sure to preload uniformly all springs (see Fig. 6).

For the adjustment follow Tab. 1 stating values of springs length according to braking torque percentage ($\%M_{\text{max}}$) compared to maximum value M_{max} .

Important: values thus obtained can slightly differ from value desired. Therefore, it is advisable to verify effective braking torques achieved through a dynamometric key inserted on drive end motor shaft.

Before putting into service, close motor with brake cover.

Periodical maintenance of brake

Verify, at regular intervals, that air-gap is included between values stated in Tab. 1 (remove the wear dust, if any).

Excessive air-gap value could produce: decrease of braking torque, rise of brake noise level, decrease of start promptness and even miss of electric release.

Adjust the **air-gap** (see Fig. 6) by releasing the nuts **45a** and by screwing the nuts **45b** in order to reach minimum air-gap, measuring the adjustment by a thickness gauge in 3 positions at 120° near the studs **25**. Tighten nuts **45a** and verify again the obtained air-gap.

After several adjustments of air-gap verify that brake disk thickness is not lower than **minimum** value S_{min} stated in Tab. 1; if necessary, replace the brake disk (refer to Fig. 6). In case of HFFW design, verify that the thickness of friction surface is at least 1 mm (initial value about 3,5 mm).

Release screw **15** must **not** be left permanently installed (to avoid dangerous or inappropriate use).

5.2 F0 and HFZ motor brake (Fig. 8).

Rectifier connection

Single-speed motors are supplied with rectifier already connected to motor terminal block. Therefore, for standard duties, motor is ready to be used without any further connections for brake supply.

For **two-speed** motors and for those driven by **inverter** it is necessary to supply independently the rectifier with proper cables pre-arranged. Refer to Fig. 7.

Verify that rectifier supply voltage is the one stated on motor name plate.

Periodical maintenance of brake

Verify, at regular intervals, that air-gap and backlash **g** (see Fig. 8) of release lever pullers, if any, are included between values stated in Tab. 2 (remove the wear dust of friction surface, if any). It is not necessary to set the backlash **g** if motor is equipped with manual release with automatic clearance taking-up (see manufacturer's catalogue).

Excessive air-gap value makes brake noise level rise and could prevent its electric release.

Important: an air-gap greater than max value can produce a decrease down to 0 of the braking torque due to the **backlash taking up of the release lever pullers; g** dimension in Fig. 8 has always to corre-

spond to the values stated in Tab. 2; too high a value makes difficult or inefficient the use of release lever.

Adjust the **air-gap** (see Fig. 8) by releasing the nuts **32** and by screwing the fastening screws **25** (for F0 and HFZW it is necessary to act through a hole of the fly-wheel) in order to reach minimum air-gap (see Tab. 2) measuring by a thickness gauge in 3 positions at 120° near the guiding bushes **28**. Tighten nuts **32** keeping in position fastening screws **25**. Verify the obtained air-gap value.

After several adjustments of air-gap, verify that brake disk thickness is not lower than the **minimum** value stated in Tab. 2; if necessary, replace the brake disk (refer to Fig. 8).

Release lever rod is **not** to be left permanently installed (to avoid dangerous or inappropriate use).

5.3 HFV, HPEV (and HFVM, HPEVM) motor brake (Fig. 10).

Rectifier connection

Single-speed motors are supplied with rectifier already connected to motor terminal block. Therefore, for standard duties, motor is ready to be used without any further connections for brake supply.

For **two-speed** motors and for those driven by **inverter** it is necessary to supply independently the rectifier with proper cables pre-arranged. Follow the instructions of Fig. 9.

Verify that rectifier supply voltage corresponds to the one stated on motor name plate.

It is not allowed to open the electromagnet supply on d.c. side of rectifier (to achieve a rapid braking).

Periodical maintenance of brake

Verify, at regular intervals, that **air-gap** is included between values stated in Tab. 3.

Excessive air-gap value could produce: decrease of braking torque up to zero, rise of brake noise level, and even miss of electric release.

Adjust the **air-gap** (see Fig. 10), **with mounted fan cover** for HFV motor, acting on self-locking nut **45** considering that the pitch is: 1 mm for size 63, 1,25 mm for sizes 71 and 80, 1,5 mm for sizes 90 ... 112, 1,75 mm for sizes 132 and 160S; for motors HPEV, acting on self-locking nut **22** keeping in mind that the pitch is: 1 mm for size 50, 1,25 mm for sizes 63 and 71, 1,5 mm for size 80.

After several adjustments of air-gap, verify that the thickness of friction surface is not lower than the **minimum** value stated in Tab. 3; if necessary, replace the brake anchor (see Fig. 10).

6. Auxiliary equipment connection

Connection of independent cooling fan

Supply wires of independent cooling fan are marked by the letter «V» on cable terminals and are connected to auxiliary terminals of the rectifier or to an other auxiliary terminal block according to Fig. 3, in function of identification code of independent cooling fan.

Independent cooling fan A, B code: connection for single-phase independent cooling fan supply (motor sizes 63 ... 90);

Independent cooling fan D, E, F, M, N, P, Q code: connection for three-phase independent cooling fan supply (motor sizes 100 ... 315S); standard supply

foresees Y-connection with voltages indicated; for Δ-connection, consult us. Verify that the direction of rotation of three-phase independent cooling fan is correct (air flow must be towards drive end; see arrow on fan cover); on the contrary invert two phases at the terminals.

During the installation verify that the supply data correspond to those of the independent cooling fan; refer to independent cooling fan code as per motor name plate; running of motors with independent cooling fan is allowed only when external fan is running; in case of frequent starts and stops, it is advised to supply the independent cooling fan continuously.

Connection of bi-metal type thermal probes, thermistor type thermal probes (PTC) and anti-condensation heater.

The connection wires are inside the terminal box and are marked by the letter «B» (bi-metal type thermal probes), «T» (thermistor type thermal probes PTC) or «S» (anti-condensation heater) on cable terminals; they are connected to auxiliary terminals of rectifier or to a further auxiliary terminal block according to Fig. 4.

Bi-metal or thermistor type thermal probes need an adequate relay or a release device.

Anti-condensation heaters must be supplied separately from motor and never during the operation.

In order to identify the type of design refer to mark on cables connected to auxiliary terminal block and relevant identification code as per motor name plate.

Connection of encoder

See specific instructions inside terminal box, see point 3.

Kalbar STP ST59 Pre Treatment (Screen Extractor OM Manual) General

Fig. 1. Collegamento motore trifase / Three-phase motor connection

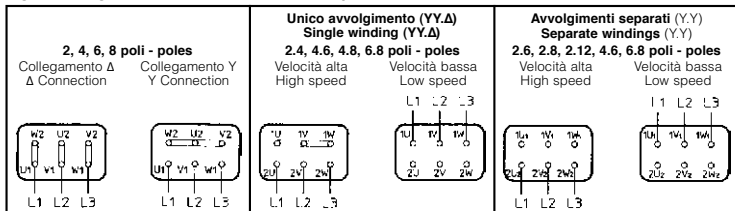
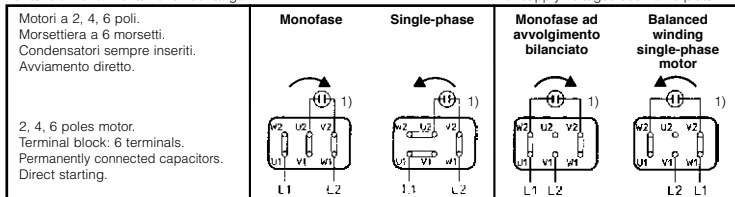


Fig. 2. Collegamento motore monofase e monofase ad avvolgimento bilanciato
Connection of single-phase and balanced winding single-phase motor

Per tensioni di alimentazione ved. targa.

For supply voltages see name plate.



1) L'eventuale condensatore ausiliario viene collegato in parallelo a quello di esercizio.

1) Auxiliary capacitor, if any, is to be connected in parallel to the running one.

Fig. 3. Collegamento del servoventilatore / Connection of independent cooling fan

Cod.	Tensione di alim. Supply voltage	Assorbimento [A] - Absorption [A]									
		63	71	80	90	100, 112	132, 160S	160, 180M	180L, 200	225, 250	280, 315S
A	230 V- \pm 5% 50/60 Hz	0,06	0,12	0,12	0,26	—	—	—	—	—	—
B	255 V- 50/60 Hz	0,05	0,11	0,11	0,23	—	—	—	—	—	—
D	3 x Y400 V- \pm 5% 50/60 Hz	—	—	—	0,13	0,15	0,26	0,41 ¹⁾	—	—	—
E	3 x Y440 V- \pm 5% 50/60 Hz	—	—	—	0,12	0,14	0,24	0,37 ¹⁾	—	—	—
F	3 x Y500 V- \pm 5% 50/60 Hz	—	—	—	0,11	0,12	0,21	0,33	—	—	—
M	3 x Δ 230 Y400 V- \pm 5% 50 Hz	—	—	—	—	—	—	—	1,49/0,86	3,1/1,2	—
	3 x Δ 277 Y480 V- \pm 5% 60 Hz	—	—	—	—	—	—	—	1,49/0,86	3,1/1,2	—
N	3 x Δ 255 Y440 V- \pm 5% 60 Hz	—	—	—	—	—	—	—	1,64/0,95	3,3/1,9	—
P	3 x Δ 220 Y380 V- \pm 5% 60 Hz	—	—	—	—	—	—	—	1,89/1,09	3,8/2,19	—
Q	3 x Δ 290 Y500 V- \pm 5% 50 Hz	—	—	—	—	—	—	—	1,20/0,69	2,4/1,39	—



Cod. A, B



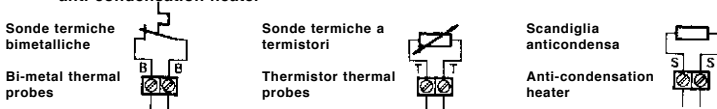
Cod. D, E, F, M, N, P, Q

1) Per alimentazione a 60Hz, motore a 4 poli.

1) For 60Hz supply, 4 poles motor.

Fig. 4. Collegamento di sonde termiche bimetalliche, sonde termiche a termistori (PTC), scaldiglia anticondensa

Connection of bi-metal type thermal probes, thermistor type thermal probes (PTC), anti-condensation heater



1) Al dispositivo di comando: $V_N = 250$ V, $I_N = 1,6$ A.

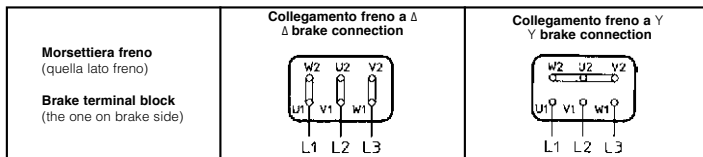
2) Termistore conforme a DIN 44081/44082.

3) Tensione di alimentazione 230 V- \pm 5% 50/60Hz (25 W per 80 ... 112, 40 W per 132 ... 160S, 50 W per 160 ... 180, 65 W per 200 ... 250, 100 W per 280, 130 W per 315S).

1) To control device: $V_N = 250$ V, $I_N = 1,6$ A.

2) Thermistor conforms to DIN 44081/44082.

3) Supply voltage 230 V- \pm 5% 50/60Hz (25 W for 80 ... 112, 40 W for 132 ... 160S, 50 W for 160 ... 180, 65 W for 200 ... 250, 100 W for 280, 130 W for 315S).



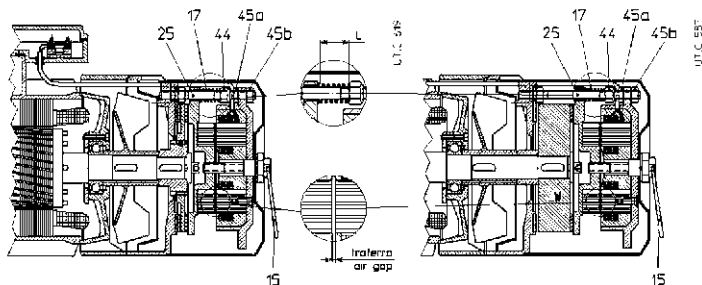
Tab. 1. Manutenzione periodica del freno motore HFF
Periodical maintenance of HFF motor brake

Grand. freno Brake size 1)	Grand. motore Motor size	Traferro Air-gap mm 4)	S_{min} mm 2)	M_f [Nm] di targhetta of name plate min max 3)		L molla per % M_{fmax} [mm] L of spring for % M_{fmax} [mm]			
						33,5	50	71	100
FA 02	63	0,25 ÷ 0,5	4,5	2	5	12,2	11,5	10,5	8,5
FA 03	71	0,25 ÷ 0,5	4,5	3	10	15,6	15	14,3	13,2
FA 04, 14	80, 90	0,3 ÷ 0,6	5	6	20 35 ⁵⁾	18,8 18 ⁵⁾	18,3 17,2 ⁵⁾	17,7 16 ⁵⁾	16,8 14,5 ⁵⁾
FA 05, 15	90, 100	0,3 ÷ 0,6	5	10	50	19	18,5	17,8	17
FA 06	112	0,35 ÷ 0,7	5	15	75	18,7	18,1	17,4	16,4
FA 07	132	0,4 ÷ 0,8	11	20	100	26,5	25,5	24	22
FA 08	132, 160S	0,4 ÷ 0,8	11	30	150	26,5	25,8	24,8	23,5
FA 09	160	0,5 ÷ 1	12	40	200	25,4	24,6	23,5	22
FA G9	180M	0,65 ÷ 1,15	6	60	300	22,2	21	19,3	17
FA 10	180L, 200	0,65 ÷ 1,15	6	80	400	37,8	36,5	35,2	33,5

- 1) La tabella vale anche con freno a c.c. tipo FC. In questo caso M_{fmax} diventa 0,8 volte il valore di tabella e il traferro max deve essere ridotto di 0,1 ÷ 0,2 mm.
- 2) Spessore minimo del disco freno.
- 3) Nel caso di esecuzione HFFW (ved. schema), con le stesse lunghezze molla si ottengono momenti frenanti metà quelli di tabella.
- 4) Nel caso di esecuzione HFFW aumentare il traferro di 0,1 mm.
- 5) Valori riferiti a FA 14.

- 1) Table is also valid with d.c. brake type FC. In this case M_{fmax} is 0,8 times the value of table and the max air-gap must be reduced by 0,1 ÷ 0,2 mm.
- 2) Minimum thickness of brake disk.
- 3) In case of HFFW design (see scheme) with same spring length, halved braking torques will be obtained compared to the table ones.
- 4) For design HFFW the air-gap must be increased by 0,1 mm.
- 5) Value referring to FA 14.

Fig. 6. Freno del motore HFF / HFF motor brake

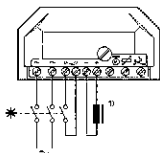
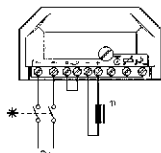


Raddrizzatore per sblocco **normale RN1** (colore blu)²⁾

Rectifier for **standard** release **RN1** (blue colour)²⁾

Frenatura normale
 Standard braking

Frenatura rapida³⁾
 Fast braking³⁾

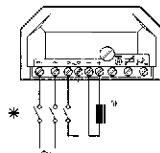
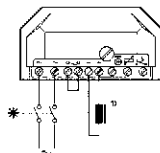


Raddrizzatore per sblocco **rapido RR1** (colore rosso)⁴⁾

Rectifier for **rapid** release **RR1** (red colour)⁴⁾

Frenatura normale
 Standard braking

Frenatura rapida³⁾
 Fast braking³⁾



- 1) Bobina freno, già collegata al raddrizzatore all'atto della fornitura.
 - 2) Schemi validi anche per raddrizzatore **RD1** (doppia semionda, colore grigio).
 - 3) Per collegamento di raddrizzatore **RN1X** e **RR1X** ved. fig. 9.
 - 4) Schemi validi anche per raddrizzatore **RR4**, **RR5** e **RR8**.
- * Il contattore di alimentazione freno deve lavorare in parallelo con il contattore di alimentazione del motore: i contatti debbono essere idonei all'apertura di carichi fortemente induttivi.

- 1) Brake coil supplied already connected to rectifier.
 - 2) Schemes valid for rectifier **RD1** (double half-wave, grey colour).
 - 3) For **RN1X** and **RR1X** rectifier connection see fig. 9.
 - 4) Schemes valid also for rectifiers **RR4**, **RR5** and **RR8**.
- * Brake supply contactor should work in parallel with motor supply contactor; the contacts should be suitable to open very inductive loads.

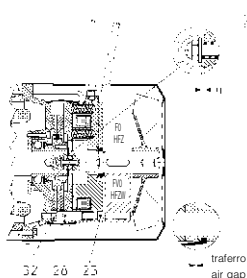
Tab. 2. Manutenzione periodica del freno motore F0, HFZ
 Periodical maintenance of F0 and HFZ motor brake

Grand. freno Brake size	Grand. motore Motor size	g mm 1)	Traferro Air-gap mm	S _{min} mm 2)
BC / ZC 02	63	0,5	0,25 ÷ 0,4	5
BC / ZC 03	71	0,5	0,25 ÷ 0,4	8
BC / ZC 04, 14	80, 90	0,6	0,3 ÷ 0,45	8
BC / ZC 05, 15	90, 100, 112	0,6	0,3 ÷ 0,45	11
BC / ZC 06, 16	112, 132	0,7	0,35 ÷ 0,55	9
BC / ZC 07	132, 160S	0,74	0,4 ÷ 0,6	11
BC / ZC 08	160, 180M	0,8	0,4 ÷ 0,6	11
BC / ZC 09	180L, 200	0,8	0,5 ÷ 0,7	13

- 1) Gioco dei tiranti della leva (eventuale) di sblocco.
- 2) Spessore minimo del disco freno.

- 1) Backlash of release lever pul-
 lers (if any).
- 2) Minimum thickness of brake
 disk.

Fig. 8. Freno del motore F0 e HFZ
 F0 and HFZ motor brake



Rectifier connection for HFV^(3, 4) and HPEV^(3, 4) motor

Raddrizzatore RV1 per freno tipo V0, VP (colore blu)²⁾ e raddrizzatore RW1 per freno tipo VG, VQ (colore rosso).

Rectifier RV1 (blue colour)²⁾ for brake type V0, VP and rectifier RW1 (red colour) for brake type VG, VQ.

- 1) Bobina freno, già collegata al raddrizzatore all'atto della fornitura.
 - 2) Per raddrizzatore **RD1** (doppia semionda, colore grigio) ved. Fig. 7.
 - 3) Schema di collegamento valido anche per raddrizzatore tipo **RN1X** o **RR1X** (colore beige).
 - 4) Per raddrizzatore **RR5** e **RR8** ved. Fig. 7.
- * Il contattore di alimentazione freno deve lavorare in parallelo con il contattore di alimentazione del motore; i contatti debbono essere idonei all'apertura di carichi fortemente induttivi.

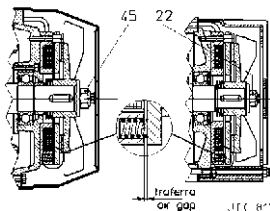
- 1) Brake coil supplied already connected to rectifier.
 - 2) For rectifier **RD1** (double half-wave, grey colour), see schemes Fig. 7.
 - 3) Wiring scheme also valid for rectifier type **RN1X** or **RR1X** (beige colour).
 - 4) For **RR5** and **RR8** rectifier see Fig. 7.
- * Brake supply contactor should work in parallel with motor supply contactor; the contacts should be suitable to open very inductive loads.

Tab. 2. Manutenzione periodica del freno motore HFV e HPEV
Periodical maintenance of HFV and HPEV motor brake

Grand. freno Brake size		Grand. motore Motor size		Traferro Air-gap mm	A _{min} mm 1)
AHFV	HPEV	HFV	HPEV		
V 02	V P2	63	50	0,25 ÷ 0,45	1
V 03	V P3	71	63	0,25 ÷ 0,45	1
V 04	V P4	80	71	0,25 ÷ 0,5	1
V 05, G5	V Q5	90	80	0,25 ÷ 0,5	1
V 06, G6		100, 112		0,3 ÷ 0,55	1, 4,5 ²⁾
V 07, G7		132, 160S		0,35 ÷ 0,6	1

- 1) Spessore minimo della guarnizione d'attrito.
- 2) Valore per VG6.
- 1) Minimum thickness of friction surface.
- 2) Value for VG6.

Fig. 10. Freno del motore HFV e HPEV
HFV and HPEV motor brake

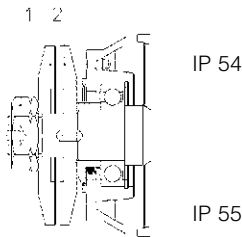


Gli schemi delle Fig. 6, 8, 10, 11 rappresentano i motori completi di alcune esecuzioni a richiesta: albero motore bloccato assialmente, V-ring, leva di sblocco manuale con ritorno automatico, guaina antipolvere, kit premilama.

Tab. 4. Momenti torcenti di serraggio per collegamenti in morsetteria
Tightening torques for terminal block connections

Filetto Thread	M4	M5	M6	M8
Momento torcente di serraggio [Nm] min	0,8	1,8	2,7	5,5
Tightening torque [Nm] max	1,2	2,5	4	8

Fig. 11. Montaggio kit premilama HPE, HPEV
Blade holding kit mounting HPE, HPEV

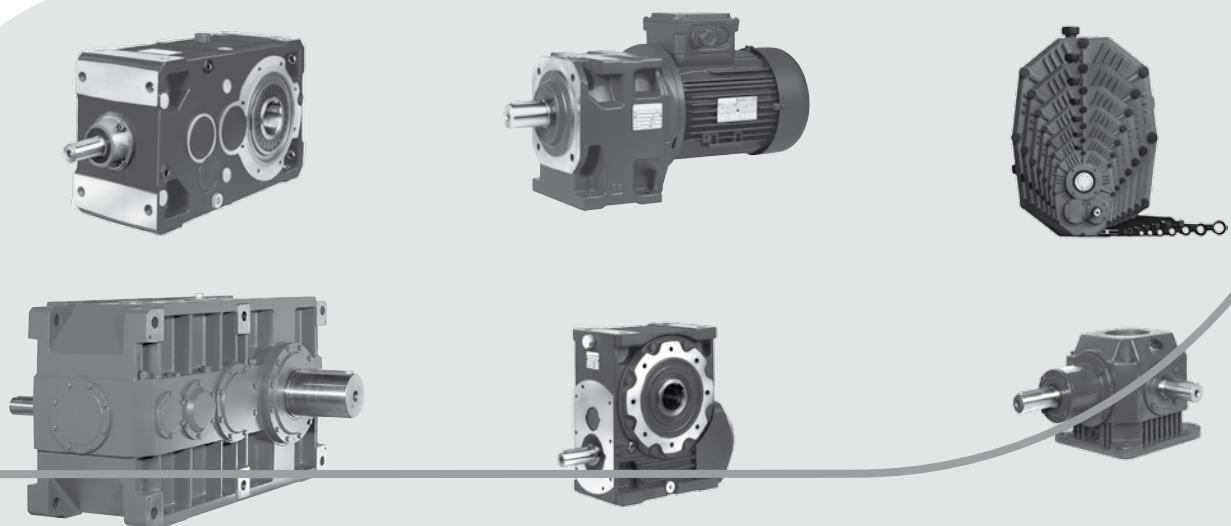


Schemes of Fig. 6, 8, 10, 11 represent motors comprehensive of some designs on request: driving shaft axially fastened, V-ring, hand lever for manual release with automatic return, dust-proof gaiter, blade holding kit.

Riduttori e motoriduttori Gear reducers and gearmotors

Istruzioni d'uso Operating instructions

Edition December 2010



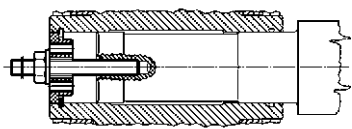


fig. 4a)

Montaggio fig. 4a) e
smontaggio fig. 4b)

Installing fig. 4a) and
removing fig. 4b)

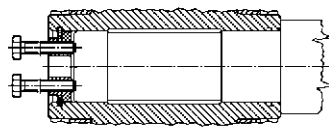
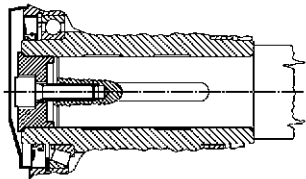
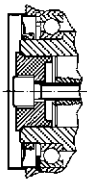


fig. 4b)

Vite grand.
32 ... 50
Worm sizes
32 ... 50

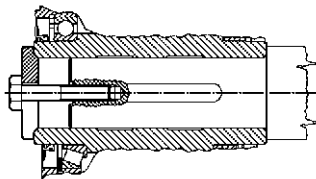
Assi paralleli e ortogonali
grand. 50
Parallel and right angle
shaft size 50



Assi paralleli e ortogonali
grand. 63
Parallel and right angle
shaft size 63

fig. 4c)

Assi paralleli e ortogonali
grand. MR 31 50
Parallel and right angle
shaft size MR 31 50

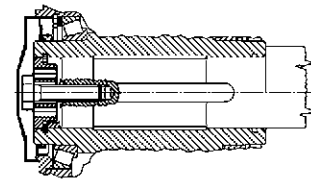
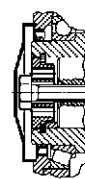


Assi paralleli e ortogonali
grand. MR 31 63
Parallel and right angle
shaft size MR 31 63

Fissaggio assiale
Axial fastening

Vite grand.
63 ... 161
Worm sizes
63 ... 161

Assi paralleli e ortogonali
grand. 64 ... 160
Parallel and right angle
shaft sizes 64 ... 160



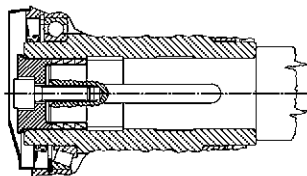
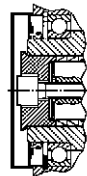
Vite grand. 200, 250
Worm sizes 200, 250

Assi paralleli e ortogonali
grand. 180 ... 360
Parallel and right angle
shaft sizes 180 ... 360

fig. 4d)

Vite grand. 32 ... 50
Worm sizes 32 ... 50

Assi paralleli e ortogonali
grand. 50
Parallel and right angle
shaft size 50



Assi paralleli e ortogonali
grand. 63
Parallel and right angle
shafts size 63

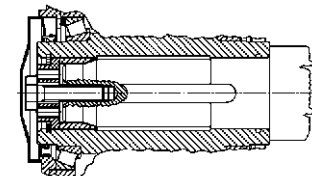
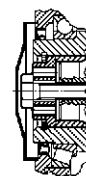
fig. 4e)

Calettamento con
linguetta e anelli di
bloccaggio fig. 4e),
con linguetta e bussola
di
bloccaggio fig. 4f)

Fitting with key
and locking rings
fig. 4e), with key
and locking bush
fig. 4f)

Vite grand. 63 ... 161
Worm sizes 63 ... 161

Assi paralleli e ortogonali
grand. 64 ... 160
Parallel and right angle
shaft sizes 64 ... 160

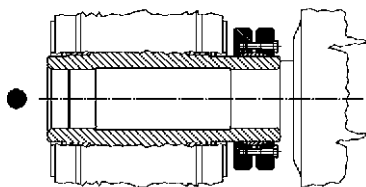


Vite grand. 200, 250
Worm sizes 200, 250

Assi paralleli e ortogonali
grand. 180 ... 360
Parallel and right angle
shaft sizes 180 ... 360

fig. 4f)

Assi paralleli e ortogonali
grand. 50 ... 125
Parallel and right angle
shaft sizes 50 ... 125



Assi paralleli e ortogonali
grand. 140 ... 631
Parallel and right angle
shaft sizes 140 ... 631

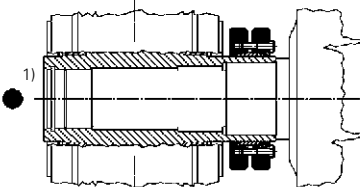
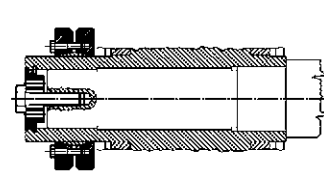


fig. 4g)

Calettamento con unità di bloccaggio fig. 4g)

Fitting with shrink disk fig. 4g)



Assi paralleli e ortogonali
grand. 400 ... 631
Parallel and right angle
shaft sizes 400 ... 631

1) Vale solo per grand. 140 ... 360.
1) Valid only for sizes 140 ... 360.

Operating instructions gear reducers and gearmotors

Contents

1 - General safety instructions	13	7.2 - Water cooling by coil	18
2 - Operating conditions	13	7.3 - Independent cooling unit	18
3 - How supplied	13	8 - Commissioning	18
3.1 - Receipt	13	9 - Maintenance	18
3.2 - Name plate	13	9.1 - General	18
3.3 - Painting	13	9.2 - Coil	19
3.4 - Protections and packing	13	9.3 - Seal rings	19
4 - Storing	14	9.4 - Motor replacement	19
5 - Installation	14	9.5 - Bearings	19
5.1 - General	14	9.6 - Metal filler plug with filter and valve	19
5.2 - Fitting of components to shaft ends	15	10 - Sound levels	19
5.3 - Shaft-mounting	15	Painting table	20
5.4 - Hollow low speed shaft	15	Table of tightening torques for axial fastening bolts and shrink disc	20
6 - Lubrication	18	Table of tightening torques for fastening bolts (foot and flange)	20
6.1 - General	18	Table of tightening torques for plugs	20
6.2 - Lubrication table	16	Gear reducer troubles: causes and corrective actions	21
6.3 - Extruder support lubrication	18		
7 - Cooling system	18		
7.1 - Cooling by fan	18		

Recycling (keeping in mind the instructions in force):

- the elements of casing, gear pairs, shafts and bearings of gear reducer must be transformed into steel scraps. The elements in grey cast iron will be subjected to the same treatment if there is no particular instruction;
- the worm wheels are made in bronze and must be treated adequately;
- exhausted oils must be recycled and treated according to the instructions.



The paragraphs marked with present symbol contain dispositions to be strictly respected in order to assure personal **safety** and to avoid any **heavy damages** to the machine or to the system (e.g.: works on live parts, on lifting machines, etc.); the responsible for the installation or maintenance must scrupulously **follow all instructions contained in present handbook**.

1 - General safety instructions

Gear reducers and gearmotors present dangerous parts because they may be:



- live;
- at temperature higher than +50 °C;
- rotating during the operation;
- eventually noisy (sound levels > 85 dB(A)).

An incorrect installation, an improper use, the removing or disconnection of protection devices, the lack of inspections and maintenance, improper connections may cause severe personal injury or property damage. Therefore the component must be moved, installed, commissioned, handled, controlled, serviced and repaired **exclusively by responsible qualified personnel** (definition to IEC 364).

It is recommended to pay attention to all instructions of present handbook, all instructions relevant to the system, all existing safety laws and standards concerning correct installation.

Attention! Components in non-standard design or with constructive variations may differ in the details from the ones described here following and may require additional information.

Attention! For the installation, use and maintenance of the electric motor (standard, brake or non-standard motor) and/or the electric supply device (frequency converter, soft-start, etc.) and accessories, if any (flow indicators, independent cooling unit, thermostat, ecc) consult the attached specific documentation. If necessary, require it.

Attention! For any clarification and/or additional information consult Rossi and specify all name plate data.

Gear reducers and gearmotors of present handbook are normally suitable for installations in industrial areas: **additional protection measures**, if necessary for different employs, must be adopted and assured by the person responsible for the installation.

IMPORTANT: the components supplied by Rossi must be incorporated into machinery and **should not be commissioned before the machinery in which the components have been incorporated conforms to:**

- **Machinery directive 2006/42/EC and subsequent updatings;**

in particular, possible safety guards for shaft ends not being used and for eventually accessible fan cover passages (or other) are the Buyer's responsibility;

- **«Electromagnetic compatibility (EMC)» directive 2004/108/EC and subsequent updatings.**

When operating on gear reducer (garmotor) or on components connected to it **the machine must be at rest:** disconnect motor (including auxiliary equipments) from power supply, gear reducer from load, be sure that safety systems are on against any accidental starting and, if necessary, pre-arrange mechanical locking devices (to be removed before commissioning).

If deviations from normal operation occur (temperature increase, unusual noise, etc.) immediately switch off the machine.

The products relevant to this handbook correspond to the technical level reached at the moment the handbook is printed. ROSSI MOTORIDUTTORI reserves the right to introduce, without notice, the necessary changes for the increase of product performances.

2 - Operating conditions

Gear reducers are designed for industrial applications according to name plate data, at ambient temperature 0 ÷ +40 °C (with peaks at -10 °C and +50 °C), maximum altitude 1 000 m.

Not allowed running conditions: application in aggressive environments having explosion danger, etc. Ambient conditions must comply with specifications stated on name plate.

3 - How supplied

3.1 - Receipt

At receipt verify that the unit corresponds to the one ordered and has not been damaged during the transport, in case of damages, report them immediately to the courier.

Avoid commissioning gear reducers and gearmotors, that are even if slightly damaged.

3.2 - Name plate

Every gear reducer presents a name plate in anodised aluminium containing main technical information relevant to operating and constructive specifications and defining, according to contractual agreements, the application limits (see fig. 1); the name plate must not be removed and must be kept integral and readable. All name plate data must be specified on eventual spare part orders.

3.3 - Painting

Products are painted according to the painting table shown on page 20. Before adding further coats of paint (use dual-compound paints only), properly protect the seal rings (which must neither be damaged nor painted), degrease and sand the gear reducer (or gearmotor) surfaces.

3.4 - Protections and packing

Overhanging free shaft ends and hollow shafts are treated with protective anti-rust long life oil and protected with a plastic (polyethylene) cap (only up to D ≤ 48 mm for overhanging shafts, D ≤ 110 mm for hollow shafts). All internal parts are protected with protective anti-rust oil.

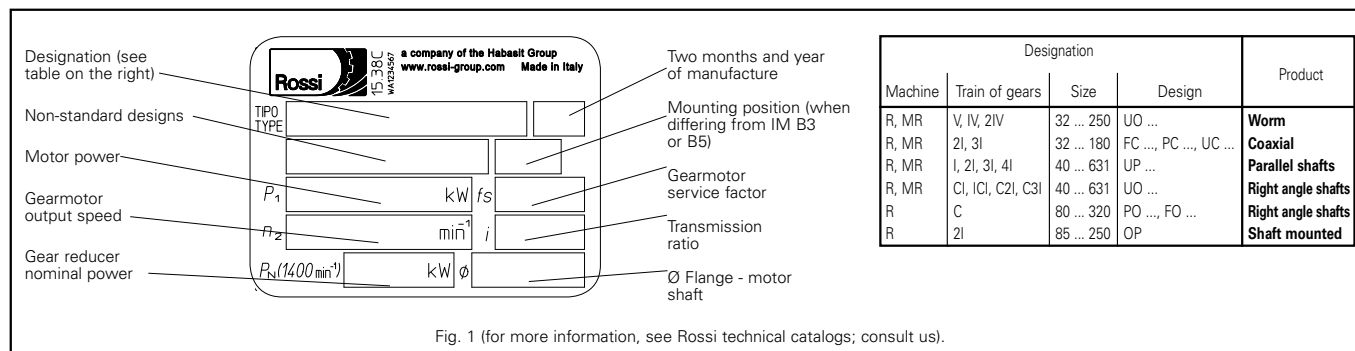


Fig. 1 (for more information, see Rossi technical catalogs; consult us).

Note: Starting from 04/05/2010 the company name ROSSI MOTORIDUTTORI S.p.A. has been changed into Rossi S.p.A., and the nameplates have been updated accordingly.

Attention! for the maintenance, installation of gear reducers coupled with synchronous and asynchronous servomotors (even if with a different name plate) follow the instructions of present handbook.

Unless otherwise agreed in the order, products are adequately packed: on pallet, protected with a polyethylene film, wound with adhesive tape and strap (bigger sizes); in carton pallet, wound with adhesive tape and strap (smaller sizes); in carton boxes wound with tape (for small dimensions and quantities). If necessary, gear reducers are conveniently separated by means of anti-shock foam cells or of filling cardboard.

Do not stock packed products on top of each other.

4 - Storing

Surroundings should be sufficiently clean, dry and free from excessive vibrations ($v_{\text{eff}} \leq 0,2 \text{ mm/s}$) to avoid damage to bearings (excessive vibration should also be guarded during transit, even if within wider range) and ambient storage temperature should be $0 \div +40 \text{ }^\circ\text{C}$: peaks of $10 \text{ }^\circ\text{C}$ above and below are acceptable.

The gear reducers filled with oil must be positioned according to the mounting position mentioned on the order during transport and storage.

Every six months rotate the shafts (some revolutions are sufficient) to prevent damage to bearings and seal rings.

Assuming normal surroundings and the provision of adequate protection during transit, the unit is protected for storage up to 1 year.

For a 2 year storing period in normal surroundings it is necessary to pay attention also to following instructions:

- generously grease the sealings, the shafts and the unpainted machined surfaces, if any, and periodically control conservation state of the protective anti-rust oil;
- for gear reducers and gearmotors supplied without oil: insert anti-condensation pastilles into the gear reducers to be replaced before due date and remove them before commissioning (as alternative completely fill the gear reducers with lubrication oil and the specified level before commissioning).

For storages longer than 2 years or in aggressive surroundings or outdoors, consult Rossi.

5 - Installation

5.1 - General

Before the installation, verify that:

- there were no damages during the storing or the transport;
- design is suitable to the environment (temperature, atmosphere, etc.);
- electrical connection (power supply, etc.) corresponds to motor name plate data;
- used mounting position corresponds to the one stated in name plate.



Attention! When lifting and transporting the gear reducer or gearmotor use through holes or tapped holes of the gear reducer casing; be sure that load is properly balanced and provide lifting systems, and cables of adequate section. If necessary, gear reducer and gearmotor masses are stated in Rossi technical catalogues.

Be sure that the structure on which gear reducer or gearmotor is fitted is plane, levelled and sufficiently dimensioned in order to assure fitting stability and vibration absence (vibration speed $v_{\text{eff}} \leq 3,5 \text{ mm/s}$ for $P_N \leq 15 \text{ kW}$ and $v_{\text{eff}} \leq 4,5 \text{ mm/s}$ for $P_N > 15 \text{ kW}$ are acceptable), keeping in mind all transmitted forces due to the masses, to the torque, to the radial and axial loads.

For the dimensions of fixing screws of gear reducer feet and the depth of tapped holes consult the Rossi technical catalogues.

Carefully select the length of fixing screws when using tapped holes for gear reducer fitting, in order to assure a sufficient meshing thread length for the correct gear reducer fitting to the machine without breaking down the threading seat.



Attention! Bearing life and good shaft and coupling running depend on alignment precision between the shafts. Carefully align the gear reducer with the motor and the driven machine (with the aid of shims if need be, for gear reducers size ≥ 400 use level tapped holes), interposing flexible couplings whenever possible.

Incorrect alignment may cause breakdown of shafts and/or bearings (which may cause overheatings) which may represent **heavy danger for people**.

Do not use motor eyebolts when lifting the gearmotors.

Position the gear reducer or gearmotor so as to allow a free passage of air for cooling both gear reducer and motor (especially at their fan side).

Avoid: any obstruction to the air flow; heat sources near the gear reducer that might affect the temperature of cooling air and of gear reducer (for radiation); insufficient air recycle and applications hindering the steady dissipation of heat.

Mount the gear reducer or gearmotor so as not to receive vibrations.

Mating surfaces (of gear reducer and machine) must be clean and sufficiently rough (approximately $Ra \geq 6,3 \text{ } \mu\text{m}$) to provide a good friction coefficient: remove by a scraper or solvent the eventual paint of gear reducer coupling surfaces.

When external loads are present use pins or locking blocks, if necessary.

When fitting gear reducer and machine and/or gear reducer and eventual flange **B5** it is recommended to use **locking adhesives** on the fastening screws (also on flange mating surfaces).

Before wiring-up the gearmotor make sure that motor voltage corresponds to input voltage. If direction of rotation is not as desired, invert two phases at the terminals.

Y-Δ starting should be adopted for no-load starting (or with a very small load) and for smooth starts, low starting current and limited stresses, if requested.

If overloads are imposed for long periods or if shocks or danger of jamming are envisaged, then motor-protection, electronic torque limiters, fluid couplings, safety couplings, control units or other similar devices should be fitted.

Usually protect the motor with a thermal cut-out however, where duty cycles involve a high number of on-load starts, it is necessary to utilise **thermal probes** for motor protection (fitted on the wiring); magnetothermic breaker is unsuitable since its threshold must be set higher than the motor nominal current of rating.

Connect thermal probes, if any, to auxiliary safety circuits.

Use varistors and/or RC filters to limit voltage peaks due to contactors.

When gear reducer is equipped with a backstop device¹⁾, provide a protection system where a backstop device breaking could cause personal injury or property damage.

Whenever a leakage of lubricant could cause heavy damages, increase the frequency of inspections and/or envisage appropriate control devices (e.g.: remote level gauge, lubricant for food industry, etc.).

In polluting surroundings, take suitable precautions against lubricant contamination through seal rings or other.

For outdoor installation or in a hostile environment (atmospheric corrosivity category **C3** according to ISO 12944-2), protect the gear reducer or gearmotor with a proper dual-compound anticorrosion paint; added protection may be afforded by applying water-proof grease (especially around the rotary seating of seal rings and at shaft end access points).

Gear reducers and gearmotors should be protected whenever possible and by appropriate means from solar radiation and extremes of weather: protection **becomes essential** when high or low speed shafts are vertically disposed or when the motor is installed vertical with fan uppermost.

For ambient temperature greater than $+40 \text{ }^\circ\text{C}$ or less than $0 \text{ }^\circ\text{C}$, consult Rossi.

When gear reducer or gearmotor is supplied with water cooling by coil or independent cooling unit, see ch 7.

¹⁾ The presence on gear reducer of backstop device is stated by the arrow near the low speed shaft, indicating the free rotation, excluding shaft mounted gear reducers where B or C designs are stated (see Rossi technical catalogues).

5.2 - Fitting of components to shaft ends

It is recommended that the holes of parts keyed onto shaft ends should be machined to H7 tolerance; for high speed shaft ends having $D \geq 55$ mm, tolerance G7 is permissible provided that the load is uniform and light; for low speed shaft end having $D \leq 180$ mm, tolerance must be **K7** if load is not uniform and light.

Before mounting, thoroughly clean mating surfaces and lubricate against seizure and fretting corrosion.

Attention! Installing and removal operations should be carried out with the aid of **jacking screws** and **pullers** using the tapped hole at the shaft butt-end (see table in fig. 2) taking care to avoid impacts and shocks which may **irremediably damage** the **bearings**, the **circlips** or other parts, for H7/m6 and K7/j6 fits it is advisable that the part to be keyed is preheated to a temperature of $80 \div 100$ °C.

Shaft ends	
D Ø	d Ø
11	M 5
14 ÷ 19	M 6
24 ÷ 28	M 8
30 ÷ 38	M 10
42 ÷ 55	M 12
60 ÷ 75	M 16
80 ÷ 95	M 20
100 ÷ 110	M 24
125 ÷ 140	M 30
160 ÷ 210	M 36
240 ÷ 320	M 45

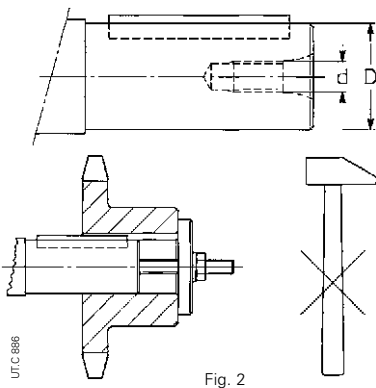


Fig. 2

The couplings having a tip speed on external diameter up to 20 m/s must be statically balanced; for higher tip speeds they must be dynamically balanced.

Where the transmission link between gear reducer and machine or motor generates shaft end loads, (see fig. 3), ensure that:

- loads do not rise above catalogue values;
- transmission overhang is kept to a minimum;
- gear-type transmissions must guarantee a minimum of backlash on all mating flanks;
- drive-chains should not be tensioned (if necessary — alternating loads and/or motion — foresee suitable chain tighteners);
- drive-belts should not be over-tensioned.

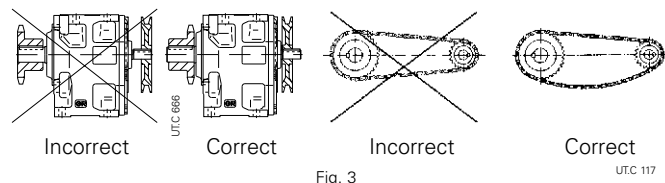


Fig. 3

5.3 - Shaft-mounting

When shaft mounted, the gear reducer must be supported both axially and radially (also for mounting positions B3 ... B8) by the machine shaft end, as well as anchored against rotation only, by means of a reaction having **freedom of axial movement** and sufficient **clearance in its couplings** to permit minor oscillations always in evidence without provoking dangerous overloading on the gear reducer.

Lubricate with proper products the hinges and the parts subject to sliding; when mounting the screws it is recommended to apply **locking adhesives**.

For the mounting of the "kit using reaction disc springs" (sizes ≤ 125 parallel shafts) use the tapped butt end hole on the shaft end of the driven machine and the flat machined chamfered surface for compressing and fitting the disc springs into the reaction recess.

Concerning the reaction system, follow the project indications stated in the technical catalogues Rossi. When-ever personal injury or property damage may occur, foresee **adequate supplementary protection devices** against:

- rotation or unthreading of the gear reducer from shaft end of driven machine following to accidental breakage of the reaction arrangement;
- accidental breakage of shaft end of driven machine.

5.4 - Hollow low speed shaft

For machine shaft ends onto which the hollow shafts of gear reducers are to be keyed, h6, j6, and k6 tolerances are recommended, according to requirements.

Important! The shoulder diameter of the shaft end of the driven machine abutting with the gear reducer must be at least $1,18 \div 1,25$ times the internal diameter of hollow shaft. For other data on machine shaft end, in case of standard hollow low speed shaft, stepped shaft, with locking rings or bush, with shrink disc see Rossi technical catalogues.



Attention! For **vertical ceiling-type** mounting and only for gear reducers equipped with locking rings or bush, gear reducer support is due only to friction, for this reason it is advisable to provide it with a fastening system.

When **installing** and **removing** gear reducers and gearmotors with hollow low speed shaft incorporating a circlip groove — whether with keyway or shrink disc — proceed as per fig. 4a and 4b, respectively, on page 12.

Warning. Even if low speed shafts are principally machined within H7 tolerance, a check using a plug could detect two areas with **slightly smaller diameters** (see Fig. 5a): this reduction is intentional and does not affect the **quality of keying** - which in fact will be **improved** in terms of **duration** and **precision** - and it does not represent an obstacle to the assembly of a machine shaft end executed according to the usual methods, such as to the one shown on Fig. 4a.

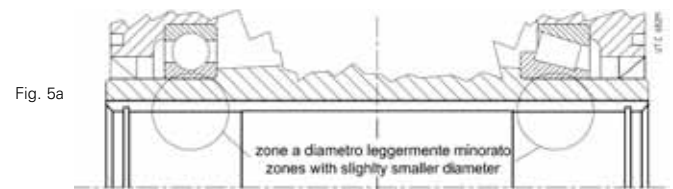


Fig. 5a

In order to remove the hollow low speed shaft of the parallel and right angle shaft gear reducers (this is the first operation to perform when disassembling the gear reducer) turn the shaft until the keyway is facing the intermediate shaft as indicated in fig. 5b and push the shaft from the reference groove side (circumferential keyway on shaft shoulder).

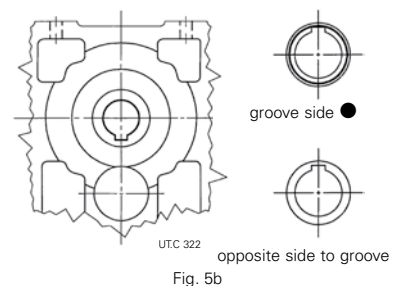


Fig. 5b

The system shown in fig. 4c and 4d, page 12, is good for **axial fastening**; when the shaft end of the driven machine has no shoulder (as in the lower half of the drawing) a spacer may be located between the circlip and the shaft end itself. Parts in contact with the circlip must have sharp edges.

The use of **locking rings** (fig. 4e, page 12) or **locking bush** (fig. 4f page 12), will permit easier and more accurate installing and removing and eliminate backlash between the key and keyway.

The locking rings or bush are fitted after mounting and after having carefully degreased the coupling surfaces. Do not use molybdenum bisulphide or equivalent lubricant for the lubrication of the parts in contact. When tightening the bolt, we recommend the use of a **locking adhesive**.

Respect the tightening torques stated in the table on page 20.

In case of axial fastening with locking rings or bush — especially when having heavy duty cycles, with frequent reversals — verify, after some hours of running, the bolt tightening torque and eventually apply the locking adhesive again.

When fitting with **shrink disc** (fig. 4g, page 12) proceed as follows:

- carefully degrease the surfaces of hollow shaft and shaft end of driven machine to be fitted;
- mount the gear reducer onto the shaft end of driven machine following the method indicated in fig. 4a, page 12;
- gradually and uniformly tighten the screws of shrink disc by a continuous sequence (not crossing) and during several phases up to a torque stated in the table on page 20;
- at operation end verify the screw tightening torque by means of a dynamometric key (flat, when it is mounted onto machine end).

6.2 - Lubrication table

Product	How supplied* and plugs	Directions for first filling																																																							
Worm sizes 32 ... 81	FILLED WITH SYNTHETIC OIL AGIP Blasia S 320, KLÜBER Klübersynth GH 6-320, MOBIL Glygoyle HE 320, SHELL Tivela S 320 Worm speed ≤ 280 min⁻¹ KLÜBER Klübersynth GH 6-680 MOBIL Glygoyle HE 680 SHELL Tivela S 680 Filler plug 1 filler plug sizes 32 ... 64 Filler/drain plug 2 filler/drain plugs for sizes 80, 81																																																								
Worm sizes 100 ... 250	WITHOUT OIL (except different statement on lubrication name plate) Filler plug with valve, drain and level plug	ISO viscosity grade [cSt] Before putting into service, fill to specified level with synthetic oil (AGIP Blasia S, ARAL Degol GS, BP-Energol SG-XP, MOBIL Glygoyle HE, SHELL Tivela S ... , KLÜBER Klübersynth GH 6...) having the ISO viscosity grade given in the table. <table><tr><th rowspan="3">Worm speed min⁻¹</th><th colspan="6">Ambient temperature 0 ÷ +40 °C²⁾</th></tr><tr><th colspan="6">Gear reducer size</th></tr><tr><th>100</th><th colspan="2">125 ... 161</th><th colspan="2">200, 250</th><th></th></tr><tr><th></th><th>B3¹⁾, V5, V6</th><th>B6, B7, B8</th><th>B3¹⁾, V5, V6</th><th>B6, B7, B8</th><th></th></tr><tr><td>2 800 ÷ 1 400³⁾</td><td>320</td><td>320</td><td>220</td><td>220</td><td></td></tr><tr><td>1 400 ÷ 710³⁾</td><td>320</td><td>320</td><td>320</td><td>220</td><td></td></tr><tr><td>710 ÷ 355³⁾</td><td>460</td><td>460</td><td>460</td><td>320</td><td></td></tr><tr><td>355 ÷ 180³⁾</td><td>680</td><td>680</td><td>460</td><td>460</td><td></td></tr><tr><td>< 180</td><td>680</td><td>680</td><td>680</td><td>680</td><td></td></tr></table> 1) Not stated on the name plate. 2) Peaks of 10 °C above and 10 °C (20 °C for ≤ 460 cSt) below the ambient temperature range are acceptable. 3) For these speeds we advise to replace oil after running-in.	Worm speed min ⁻¹	Ambient temperature 0 ÷ +40 °C ²⁾						Gear reducer size						100	125 ... 161		200, 250				B3 ¹⁾ , V5, V6	B6, B7, B8	B3 ¹⁾ , V5, V6	B6, B7, B8		2 800 ÷ 1 400 ³⁾	320	320	220	220		1 400 ÷ 710 ³⁾	320	320	320	220		710 ÷ 355 ³⁾	460	460	460	320		355 ÷ 180 ³⁾	680	680	460	460		< 180	680	680	680	680	
Worm speed min ⁻¹	Ambient temperature 0 ÷ +40 °C ²⁾																																																								
	Gear reducer size																																																								
	100	125 ... 161		200, 250																																																					
	B3 ¹⁾ , V5, V6	B6, B7, B8	B3 ¹⁾ , V5, V6	B6, B7, B8																																																					
2 800 ÷ 1 400 ³⁾	320	320	220	220																																																					
1 400 ÷ 710 ³⁾	320	320	320	220																																																					
710 ÷ 355 ³⁾	460	460	460	320																																																					
355 ÷ 180 ³⁾	680	680	460	460																																																					
< 180	680	680	680	680																																																					
Coaxial sizes 32 ... 41 Right angle shaft (cat. L) sizes 80 ... 125	FILLED WITH SYNTHETIC GREASE SHELL Tivela GL 00 IP Telesia Compound A MOBIL Glygoyle Grease 00 Filler/drain plug (only for coaxial)																																																								
Coaxial sizes 50 ... 81 Parallel and right angle shaft sizes 40 ... 81	FILLED WITH SYNTHETIC OIL KLÜBER Klübersynth GH 6-220 MOBIL Glygoyle 30 SHELL Tivela S 220 Filler/drain plug 2 filler/drain plugs for sizes 80, 81																																																								
Coaxial sizes 100 ... 180 Parallel and right angle shaft sizes 100 ... 631 Right angle shaft (cat. L) sizes 160 ... 320 Shaft mounted	WITHOUT OIL ** (except different statement on lubrication name plate) Filler plug with valve (with breathing for shaft mounted gear reducers), drain and level plugs	Before putting into service, fill to specified level with mineral oil (AGIP Blasia, ARAL Degol BG, BP-Energol GR-XP, ESSO Spartan EP, IP Mellana oil, MOBIL Mobilgear 600, SHELL Omala, TEXACO Meropa, TOTAL Carter EP) or polyglycol** synthetic oil (KLÜBER Klübersynth GH6 ..., MOBIL Glygoyle, SHELL Tivela S) or polyalphaolefines** synthetic oil (AGIP Blasia SX, CASTROL Tribol 1510, ELF Reductelf SYNTHÈSE, ESSO Spartan SEP, KLÜBER Klübersynth EG4, MOBIL SHC Molykote L11 ...) having the ISO viscosity grade given in the table. ISO viscosity grade [cSt] <table><tr><th colspan="2">Speed n₂ min⁻¹</th><th colspan="3">Ambient temperature¹⁾ [°C]</th></tr><tr><th>Right angle shaft</th><th>Others</th><th colspan="2">mineral oil</th><th>synthetic oil</th></tr><tr><th></th><th></th><th>0 ÷ 20</th><th>10 ÷ 40</th><th>0 ÷ 40</th></tr><tr><td>> 710</td><td>> 224</td><td>150</td><td>150</td><td>150</td></tr><tr><td>710 ÷ 280</td><td>224 ÷ 22,4</td><td>150</td><td>220</td><td>220</td></tr><tr><td>280 ÷ 90</td><td>22,4 ÷ 5,6</td><td>220</td><td>320</td><td>320</td></tr><tr><td>< 90</td><td>< 5,6</td><td>320</td><td>460</td><td>460</td></tr></table> 1) Peaks of 10 °C (20 °C) below and 10 °C above the ambient temperature range are acceptable.	Speed n ₂ min ⁻¹		Ambient temperature ¹⁾ [°C]			Right angle shaft	Others	mineral oil		synthetic oil			0 ÷ 20	10 ÷ 40	0 ÷ 40	> 710	> 224	150	150	150	710 ÷ 280	224 ÷ 22,4	150	220	220	280 ÷ 90	22,4 ÷ 5,6	220	320	320	< 90	< 5,6	320	460	460																				
Speed n ₂ min ⁻¹		Ambient temperature ¹⁾ [°C]																																																							
Right angle shaft	Others	mineral oil		synthetic oil																																																					
		0 ÷ 20	10 ÷ 40	0 ÷ 40																																																					
> 710	> 224	150	150	150																																																					
710 ÷ 280	224 ÷ 22,4	150	220	220																																																					
280 ÷ 90	22,4 ÷ 5,6	220	320	320																																																					
< 90	< 5,6	320	460	460																																																					

Independently-lubricated bearings, motor-bearings, backstop device fitted to motor:

lubrication is «for life» (except some cases of motors in which relubrication device is adopted). Should there be either a possibility of the grease becoming contaminated, or a very heavy type of duty-cycle, it is good policy to check on the state of the grease (between one change and the next, or every year or 2 years) and remove and replace grease in independently-lubricated bearings (every change or every other change, or every 2 or 4 years). Bearings should be filled with ESSO BEACON 3 bearing-grease for ball bearings, KLÜBER STABURAGS NBU 8 EP for roller bearings; lubricate the backstop device with ESSO BEACON 2.

Oil-change interval and lubricant quantity

Oil quantity [l] for **worm** gear reducers sizes **32 ... 81**

For the other sizes the quantity is given by the level stated by the proper plug.

Size	R V, MR V			R IV, MR IV			MR 2IV			
	B3 ¹⁾ , V5, V6	B6, B7	B8 ¹⁾	B3 ¹⁾ , V5, V6	B6, B7	B8 ¹⁾	B3 ¹⁾	B6, B7	B8 ¹⁾	V5, V6
32	0,16	0,2	0,16	0,2	0,25	0,2	—	—	—	—
40	0,26	0,35	0,26	0,32	0,4	0,32	0,42	0,5	0,42	0,42
50	0,4	0,6	0,4	0,5	0,7	0,5	0,6	0,8	0,6	0,6
63, 64	0,8	1,15	0,8	1	1,3	1	1,2	1,55	1,2	1,2
80, 81	1,3	2,2	1,7	1,5	2,5	2	1,7	2,8	2,3	1,8

1) Not stated on name plate (B8, only sizes 32 ... 64).

Ambient temperature 0 ÷ +40 °C with peaks up to -20 °C and +50 °C.

An overall guide to **oil-change interval** is given in the table, and assumes pollution-free surroundings. Where heavy overloads are present, halve the values.

Apart from running hours, replace or regenerate the oil each 5 ÷ 8 years according to size, running and environmental conditions.

Oil temperature [°C]	Oil-change interval [h]
≤ 65	18 000
65 ÷ 80	12 500
80 ÷ 95	9 000
95 ÷ 110	6 300

Grease quantity [kg] for coaxial gear reducers

Size	R 2I, MR 2I, 3I			
	B3 ¹⁾ , B6, B7, B8	V5, V6	B5 ¹⁾	V1, V3
32	0,14	0,25	0,1	0,18
40, 41	0,26	0,47	0,19	0,35

1) Non stated on name plate

Ambient temperature 0 ÷ +40 °C with peaks up to -20 °C and +50 °C.

Lubrication «for life» (assuming external pollution-free environment). Oil quantity [l] for sizes **50 ... 81**

Coaxial size	R 2I, 3I, MR 2I, 3I		
	B3 ¹⁾	B6, B7, B8, V6	V5
50, 51	0,8	1,1	1,4
63, 64	1,6	2,2	2,8
80, 81	3,1	4,3	5,5

1) Not stated on name plate.

2) Values valid for R 2I; for MR 2I the values are respectively: 0,8; 1,2; 2,3.

3) The first reduction stage (the first two for 4I) is lubricated with grease for life.

Ambient temperature 0 ÷ +40 °C with peaks up to -20 °C and +50 °C.

Parallel size	R I			R 2I, MR 2I			R 3I, MR 3I			MR 4I			
	B3 ¹⁾ , B8	B7	B6, V5, V6	B3 ¹⁾ , B8	B6 ²⁾	B7, V5, V6	B3 ¹⁾ , B8	B6	B7, V5 ³⁾ , V6	B3 ¹⁾ , B8	B6	B7, V6	V5 ³⁾
40	—	—	—	0,4	0,9	0,55	0,47	0,7	0,6	—	—	—	—
50	—	—	—	0,6	0,9	0,8	0,7	1,05	0,9	—	—	—	—
63, 64	0,7	0,8	1	0,9	1,4	1,2	1	1,5	1,3	1,1	1,8	1,4	1,3
80	1,2	1,5	1,9	1,5	2,7	2,3	1,7	2,9	2,5	1,9	3,2	2,7	2,5

Right angle size	R CI, MR CI			R ICI, MR ICI				MR C3I			
	B3 ¹⁾ , B6, B7	B8	V5, V6	B3 ¹⁾ , B7	B6	B8	V5, V6	B3 ¹⁾ , B7	B6	B8	V5, V6
40	0,26	0,35	0,3	0,31	0,5	0,4	0,35	—	—	—	—
50	0,4	0,6	0,45	0,45	0,8	0,65	0,5	0,5	0,9	0,7	0,55
63, 64	0,8	1	0,95	1	1,6	1,2	1,15	1,2	1,8	1,4	1,35
80, 81	1,3	2	1,8	1,6	2,7	2,2	2	1,9	3	2,5	2,3

An overall guide to **oil-change interval** is given in the table, and assumes pollution-free surroundings. Where heavy overloads are present, halve the values.

Apart from running hours:

— replace mineral oil each 3 years;

— replace or regenerate synthetic oil each 5 ÷ 8 years according to gear reducer size, running and environmental conditions.

The oil quantity is given by the level stated by the proper plug.

Oil temperature [°C]	Oil-change interval [h]	
	mineral oil	synthetic oil
≤ 65	8 000	25 000
65 ÷ 80	4 000	18 000
80 ÷ 95	2 000	12 500
95 ÷ 110 ¹⁾	—	9 000

1) Values admissible only for parallel, right angle shaft gear reducers (cat. G and L) an for non-continuous duties.

* Identification through specific lubrication name plate.

** Lubrication with synthetic oil (polyglycol basis must be with special internal painting; polyalphaolefines basis is advisable for sizes ≥ 200 and obligatory for sizes ≥ 400). It is always recommended, particularly for: high speed gear reducers, increase of oil-change interval («long life»), increase of the ambient temperature range, increase of the thermal power or decrease of oil temperature.


6 - Lubrication

6.1 - General

Depending on type and size, gear reducers and gearmotors may be grease-lubricated and supplied **FILLED WITH GREASE**, or (synthetic or mineral) oil-lubricated and supplied **FILLED WITH OIL** or **WITHOUT OIL** depending on type and size (see ch. 6.2). When supplying **WITHOUT OIL**, the filling up to specified level (normally stated by means of transparent level plug) is Buyer's responsibility.

Every gear reducer has a **lubrication plate**.

Concerning lubricant type and quantity, gear reducer type, how supplied, plugs, filling instructions, oil-change interval, etc. see lubrication table (6.2).

Be sure that for gear reducers and gearmotors size ≥ 100 , the filler plug is provided with a valve (symbol ); otherwise, replace it with the one normally supplied with.

When gear reducer or gearmotor is provided with a **spilway plug** (red colour) fill after unscrewing a.m. plug in order to check the obtained level by oil outlet.

When gear reducer or gearmotor is provided with a **level plug with rod**, fill with oil up to specified level on rod.

When gear reducer or gearmotor is supplied with a level plug (size ≥ 100), the necessary lubricant quantity is that which **reaches a.m. level in center line of plug (gear reducer at rest)** and not the approximate quantity given on the catalogue.

Usually bearings are automatically and continuously lubricated (bathed, splashed, through pipes or by a pump) utilising the main gear reducer lubricant. The same applies for backstop devices, when fitted to gear reducers.

In certain gear reducers in vertical mounting positions V1, V3, V5 and V6, and right-angle shaft gear reducers in horizontal positions B3, B6 and B51 (though not gearmotors in this case, for which the above indications hold good) upper bearings are independently lubricated with a special grease «for life», assuming pollution-free surroundings. The same applies for motor bearings (except some cases in which relubrication device is adopted) and backstop devices when fitted to motors.

Always be sure that the gear reducer is located as per the mounting position ordered, which appears on the name plate. When no indication is given, the gear reducer may be used in horizontal mounting position B3 or B5 (B3, B8, worm gear reducers size ≤ 64), or vertical position V1 (in the case of right angle shaft gear reducers in the design incorporating flange FO1...).

Combined gear reducer units. Lubrication remains independent, thus data relative to each single gear reducer hold good.

6.3 - Extruder support lubrication (parallel and right angle shaft)

The lubrication of **extruder support** is **separate** from the gear reducer, except:

- for designs HA ... HC;
- in presence of the independent cooling unit, if applied to lubricate both the gear reducer and the support.

The **separate lubrication** of extruder support sensibly improves the reliability and real life of the axial bearing; the separation between gear reducer and support is granted by a seal ring.

With separate lubrication, for the extruder support, use polyalphaolephines based synthetic oil (MOBIL SHC XMP 680, CASTROL Tribol 1510/680) with **ISO 680 cSt** viscosity grade.

With **common lubrication** (designs HA ... HC in presence of independent cooling unit, if applied to lubricate both the gear reducer and the support), lubricant ISO viscosity grade must be according to the instructions given in ch. 6.2 «lubrication table» and oil must be polyalphaolephine based synthetic type.

For the filling up of oil of extruder support, see the table below.

Gear reducer size	Lubrication of extruder support	
	Separate lubrication ¹⁾	Joint lubrication ²⁾
125 ... 451	Filling up to the level (of support)	Filling up to the level (of gear reducer)

1) Support with metal filler plug with filter and valve, level and draining plug.

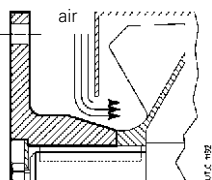
2) The level is metal only in the gear reducer casing.

For the lubrication of gear reducer refer to ch. 6.2, lubrication table.

7 - Cooling system

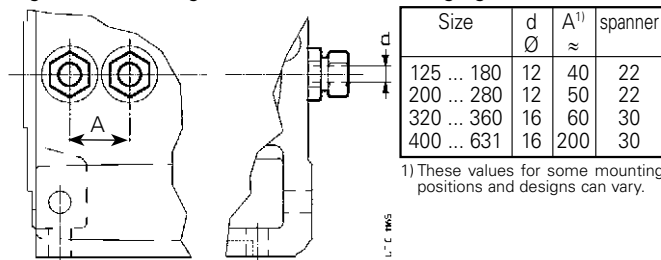
7.1 - Cooling by fan

If there is fan on the gear reducer verify that there is sufficient space allowing for adequate circulation of cooling air also after fitting coupling protection. If a coupling protection is fitted (drilled case or wire netting), smooth the coupling hub, if necessary.



7.2 - Water cooling by coil

The presence of coil is given by water inlets (pipes DIN 2353) protruding from the casing as shown in the following figure.



1) These values for some mounting positions and designs can vary.

Attention: Do not tamper with the eventual stop plate in order to keep the pipes them locked; in particular keep the pipe locked while tightening the nut of connection pipe. Water fed into the system must:

- be not too hard;
- be at max temperature $+20\text{ }^{\circ}\text{C}$;
- flow at $10 \div 20\text{ dm}^3/\text{min}$;
- have a pressure $0,2 \div 0,4\text{ MPa}$ ($2 \div 4\text{ bar}$).

Where ambient temperature may be less than $0\text{ }^{\circ}\text{C}$, make provision for water drain and compressed air inlet, so as to be able to empty out the coil completely and avoid freezing up.

When risking high input pressure peaks, install a safety valve set to a proper operating threshold.

7.3 - Independent cooling unit

See specific documentation supplied together with the unit.

8 - Commissioning

Carry out an overall check, making particularly sure that the gear reducer is filled with lubricant.

Where star-delta starting is being used, input voltage must match the motor lower voltage (Δ connection).

For asynchronous three-phase motor, if the direction of rotation is not as desired, invert two phases at the terminals.

Before running gear reducers fitted with **backstop device**, make sure that the **direction of rotation in machine, gear reducer and motor all correspond correctly**.



Attention! One or more startings in the false direction, even if short, could irretrievably damage the backstop device, the coupling seats and/or the electric motor.

A **running-in** period is advisable:

- of approx. $400 \div 1\,600\text{ h}$ for gear reducers with worm gear pairs in order to reach maximum efficiency;
- of approx. $200 \div 400\text{ h}$ for gear reducers with bevel and/or cylindrical gear pairs in order to reach maximum functionality.

The temperature of both gear reducer and lubricant may well rise beyond normal values during running-in. After the running-in period it may be necessary to verify the gear reducer fastening bolt tightness.

Note: worm gear reducer efficiency is lower in the **first running hours** (about 50) and at every cold starting (efficiency will be better with oil temperature increasing). For further information consult Rossi technical catalogues.

9 - Maintenance

9.1 - General

At machine rest, verify at regular intervals (more or less frequently according to environment and use):

- all external surfaces are clean and air passages to the gear reducer or gearmotors are free, in order that cooling remains fully effective;
- oil level and deterioration degree (check with cold gear reducer at rest);
- the correct fastening screws tightening.

During the operation check:

- noise level;
- vibrations;
- seals;
- etc.



Attention! After a running period, gear reducer (excluding the shaft mounted gear reducers) is subject to a light internal overpressure which may cause burning liquid discharge. Therefore, before loosening whichever plug wait until gear reducer has become cold; if not possible, take the necessary protection measures against burning due to warm oil contact. In all cases, always proceed with great care.

Maximum oil temperatures indicated in lubrication table (see ch.6.2) do not represent a hindrance to the gear reducer regular running.

Oil change. Execute this operation at machine rest and cold gear reducer.

Prearrange a proper drain oil collection, unscrew both the drain plug and the filler plug in order to facilitate oil draining; dispose the exhaust lubricant in compliance with the laws in force.

Wash the inside part of gear reducer housing using the same oil type suitable for the running; the oil used for this wash can be applied for further washings after proper filtering by 25 µm of filtration standard.

Fill in the gear reducer again up to level.

It is always recommended to replace the seal rings (see ch. 9.3)

When dismantling the cap (whenever gear reducers are provided with), reset the sealing with adhesive on cleaned and degreased mating surfaces.

9.2 - Coil

In case of long non-running periods at ambient temperatures lower than 0 °C, the coil should be emptied out using compressed air to blast out all the coolant, so as to avoid freezing-up which would cause the coil to break.

9.3 - Seal rings

It is always recommended that the seal rings are replaced with new ones when they are removed or during periodic checks of gear reducer; in this case, the new ring should be generously greased and positioned so that the seal line does not work on the same point of sliding contact as the previous ring.

Oil seals must be protected against heat radiation, also during the shrink fitting of parts, if applicable.

Duration depends on several factor such as dragging speed, temperature, ambient conditions, ect.; as a rough guide; it can vary from 3 150 to 25 000h.

9.4 - Motor replacement

Since gearmotors are realised with **standardised** motor, motor replacement – in case of failure – is extremely easy. Simply observe the following instructions:

- be sure that the mating surfaces are machined under accuracy rating (IEC 60072-1);
- clean surfaces to be fitted thoroughly;
- check and, if necessary, lower the parallel key so as to leave a clearance of $0,1 \div 0,2$ mm between its top and the bottom of the keyway of the hole. If shaft keyway is without shoulder, lock the key with a pin.

For worm gearmotors MR V, parallel shaft gearmotors MR 2I and MR 3I 140 ... 360, right angle shaft gearmotors MR CI, C2I (motor shaft end keyed directly into the worm, the cylindrical or bevel pinion shaft, respectively);

- check that the fit-tolerance (push-fit) between hole and shaft end is G7/j6 for $D \leq 28$ mm, F7/k6 for $D \geq 38$ mm;
- lubricate surfaces to be fitted against fretting corrosion.

For parallel shaft gearmotors (2I, 3I) with motor size 200 ... 315 and gearmotors MR V, MR 2I and MR CI with non-standard design «Square flange for servomotors», proceed as follows for disassembling:

- align the key through hole with the tightening screw of the hub clamp;
- loosen the tightening screw and consequently the hub clamp;
- disassemble the motor.

For worm gearmotors MR IV and MR 2IV, parallel shaft gearmotors MR 3I 40 ... 125 and MR 4I, right angle shafts gearmotors MR CI and MR C3I, coaxial gearmotors (cylindrical pinion keyed on to the motor shaft end);

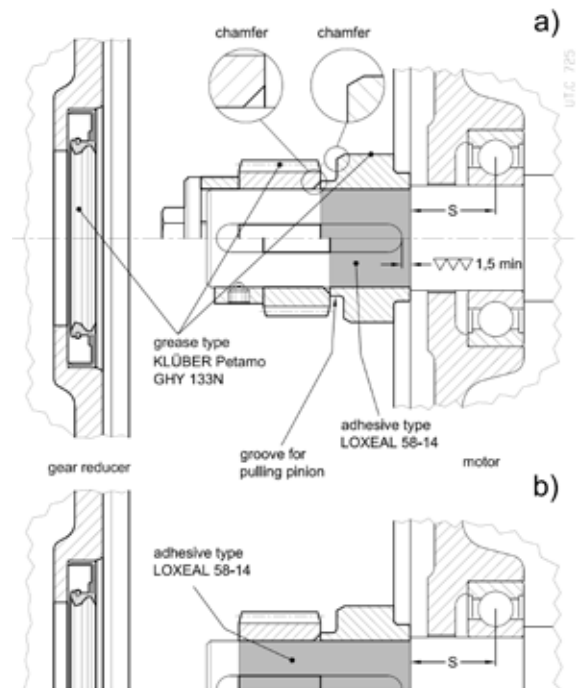
- check that the fit-tolerance (standard locking) between hole and shaft end is K6/j6 for $D \leq 28$ mm, and J6/k6 for $D \geq 38$ mm;
- make sure that the motors have bearing location and overhang (distance S) as shown in the table;

Motor size	Min dynamic load capacity daN		Max dimension 'S' mm
	Front	Rear	
63	450	335	16
71	630	475	18
80	900	670	20
90	1 320	1 000	22,5
100	2 000	1 500	25
112	2 500	1 900	28
132	3 550	2 650	33,5
160	4 750	3 350	37,5
180	6 300	4 500	40
200	8 000	5 600	45
225	10 000	7 100	47,5
250	12 500	9 000	53
280	16 000	11 200	56

- mount onto the motor shaft as follows:

- **the spacer** pre-heated at **65° C** treating the relevant motor shaft area with **adhesive type LOXEAL 58-14** and checking that between keyway and motor shaft shoulder there is a cylindrical part ground by 1,5 mm at least; pay attention **not to damage the external surface** of spacer;
- **the key** in the keyway, making sure that a contact length of at least 0,9 times the pinion width is present;
- **the pinion** pre-heated at **80 ÷ 100 °C**;

- **the axial fastening system** when foreseen (self locking screw on motor shaft butt-end with washer and spacer or hub clamp with 1 or more dowels, fig. a); for the cases foreseen without axial fastening (fig. b), apply adhesive type LOXEAL 58-14 also on the motor shaft part laying under the **pinion**;
- in case of axial fastening system with hub clamp and dowels, make sure that they do not overhang from spacer external surface: screw the dowels completely and, if necessary, imprint the motor shaft with a point;
- grease (with grease type KLÜBER Petamo GHY 133N) the pinion teeth, the seal ring rotary seating and the ring itself, and assemble carefully.



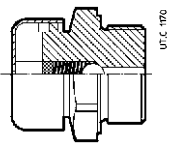
9.5 - Bearings

Since there are many different types of bearings in a gear reducer (roller, tapered roller, straight roller, etc.) and each bearing works with different loads and speeds depending on the input speed, the nature of the load of the driven machine, the transmission ratio, etc., and with different lubricants (oil bath, oil splash, grease, oil circulation, etc.), it is not possible to define any periodical maintenance and replacement of bearings in advance.

If a precautionary maintenance is required, **undertake periodical checks to verify noise level and vibration with the help of appropriate diagnostic equipment and instruments**. If the measured values worsen even slightly it is necessary to stop gear reducer or gear motor and after having inspected inside the unit replace the bearings which are subject to breakdown.

9.6 - Metal filler plug with filter and valve

When the gear reducer or gearmotor (size ≥ 100) is equipped with metal filler plug with filter and valve (see fig.), in order to clean it, it is necessary to unscrew it from the gear reducer (preventing any debris or other foreign items from entering the reducer, disassemble the cover, wash it with solvent, dry with compressed air and reassemble it). This operation is to be made according to environment conditions.



10 - Sound levels

Most of the Rossi product range is characterised by **sound pressure levels L_{PA}** (mean value of measurement, assuming nominal load and input speed $n_1 = 1 400 \text{ min}^{-1}$, at 1 m from external profile of gear reducer standing in free field on a reflecting surface, according to draft proposal ISO/CD 8579) **lower or equal to 85 dB(A)**.

The table indicates the products which **can exceed** a.m. threshold. For further information about sound levels of every single product see Rossi technical catalogues.

Machine/Train of gears		i_n	Size
Parallel shaft	R I	$\leq 3,15$	≥ 160
		≥ 4	≥ 200
	R 2I	all	≥ 320
	R 3I	all	≥ 400
Right angle shaft	R 4I	≤ 160	≥ 500
		≥ 200	≥ 630
	R CI	all	≥ 320
	R C2I	≤ 63	≥ 400
Right angle shaft	R C	≥ 71	≥ 500
		all	≥ 630

Painting table

Product	Size	Internal painting	External painting		Notes
			Final color Blue RAL 5010	Features	
Worm Parallel and right angle Coaxial type	32 ... 81 40 ... 81 32 ... 41	Epoxy powder (prepainted)	Epoxy powder (prepainted)	Resistant to atmospheric and aggressive agents (atmospheric corrosivity category C3 according to ISO 12944-2). Suitable for further coats of dual-compound paints only ³⁾	Machined parts remain unpainted and are protected with an easily removable anti-rust oil (before painting remove the protective oil)
Worm Coaxial type Parallel and right angle Coaxial type Right angle Right angle Shaft mounted	100 ... 250 50 ... 81 100 ... 631 100 ... 180 160 ... 320 80 ... 125 (cat. L)	Single-compound ester epoxy or phenolic resin basis primer (prepainted)	Single-compound ester epoxy or phenolic resin basis primer (prepainted) + Water-soluble polyacrylic dual-compound enamel	Resistant to atmospheric and aggressive agents (atmospheric corrosivity category C3 according to ISO 12944-2). Suitable for further coats of dual-compound paints only ³⁾ . Machined parts are painted with water-soluble polyacrylic dual-compound enamel	The internal painting does not resist polyglycol synthetic oils (polyalphaolefines synthetic oils are suitable). Remove by a scraper or solvent the possible paint of gear reducer coupling surfaces
Right angle Shaft mounted Coaxial²⁾ Right angle shaft²⁾	80 ... 125 (cat. L) 56 ... 142 85 ... 142	—	Water-soluble polyacrylic dual-compound enamel	Resistant to atmospheric and aggressive agents (atmospheric corrosivity category C3 according to ISO 12944-2). Suitable for further coats of dual-compound paints only ³⁾	Remove by a scraper or solvent the possible paint of gear reducer coupling surfaces
		—	Dual-compound epoxy polyamide primer + Water-soluble dual-compound polyacrylic enamel (matt black RAL 9005)	Resistant to atmospheric and aggressive agents (atmospheric corrosivity category C3 according to ISO 12944-2). Suitable for further coats of dual-compound paints only ³⁾	Machined parts remain unpainted and are protected with an easily removable anti-rust oil (before painting remove the protective oil)

1) When gear reducers are coupled with servomotors (servogearmotors) the final colors is matt black RAL 9005.

2) Integrated low backlash planetary servogearmotors.

3) Before adding further coats of paint, properly protect the seal rings and carefully degrease and sand the gear reducer surfaces.

Table of tightening torques for axial fastening bolts and shrink disc²⁾

Worm gear reducers size	32	40	50	—	63, 64	—	80, 81	100	125, 126	160	161	—	200	—	250	—	—	—	—	—	—	—	—	—
Parallel and right angle shaft size	40	50	—	63	64	80	81	100	125	140	—	160	180	200	225	250	280	320, 321	360	400, 401	450, 451	500, 501	560, 561	630, 631
M [daN m] for rings or bush	2,9	3,5	4,3	4,3	4,3	5,1	5,3	9,2	17	21	21	34	43	66	83	135	166	257	315	—	—	—	—	—
Bolts for axial fastening UNI 5737-88 class 10.9	M8 ¹⁾	M8 ¹⁾	M10 ¹⁾	M10	M10	M10	M10	M12	M14	M16	M16	M20	M20	M24	M24	M30	M30	M36	M36	M30	M30	M36	M36	M36
M [daN m] for shrink disc	—	0,4	—	1,2	1,2	1,2	—	3	3	3	—	6	6	10	10	25	25	25	25	49	49	49	49	84
Bolts for shrink disc UNI 5737-88 class 10.9	—	M5	—	M6	M6	M6	—	M8	M8	M8	—	M10	M10	M12	M12	M16	M16	M16	M16	M20	M20	M20	M20	M24

1) For worm gear reducers UNI 5931-84.

2) The bolts of shrink disc must be gradually and uniformly tightened, with continuous sequence (not diagonally!) and in several phases up to the reaching of maximum tightening torque stated on table.

Table of tightening torques fastening bolts (foot and flange)

Bolt	M (daN m) UNI 5737-88	
	class 8.8	class 10.9
M5	0,6	0,85
M6	1,1	1,5
M8	2,5	3,5
M10	5	7,1
M12	8,5	12
M14	13,5	19
M16	20,5	29
M18	28	40
M20	40	56
M22	55	77
M24	71	100
M27	100	140
M30	138	195
M33	200	280
M36	250	355
M39	295	420
M42	410	580
M45	500	710
M48	610	860
M56	980	1380

Table of tightening torques for plugs

Thread dimension	[daN m]
G 1/4"	0,7
16 MB	1,4
G 1/2"	1,4
G 3/4"	1,4
G 1"	2,5

Note

- Class 8.8 is usually sufficient.

- Before tightening the bolt be sure that the eventual centering of flanges are inserted properly

- The bolts are to be diagonally tightened with the maximum tightening torque.

Gear reducer troubles: causes and corrective actions

Trouble	Possible causes	Corrective actions
Excessive oil temperature	Inadequate lubrication: – excessive or insufficient oil quantity;	Check: – oil level (gear reducer at rest) or quantity
	– unsuitable lubricant (different type, too viscous, exhausted, etc.)	– lubricant type and/or state (see ch. 6.2 lubrication table); replace if necessary
	wrong mounting position	Change mounting position
	Too tightened taper roller bearings	Consult Rossi
	Worm gear reducer with excessive load during running-in	Reduce the load
	Excessive ambient temperature	Increase the cooling or correct the ambient temperature
	Obstructed passage of air	Eliminate obstructive material
	Slow or missing air recycle	Arrange auxiliary ventilation
	Radiance	Screen gear reducer and motor properly
	Inefficiency of auxiliary bearing lubrication system	Check the pump and the pipes
	Worn, faulty or badly lubricated bearings	Consult Rossi
	Inefficient or out of service oil cooling system: obstructed filter, insufficient oil (exchanger) or water (coil) flow rate, pump out of service, water temperature >20 °C, etc.	Check pump, pipes, oil filter and safety devices efficiency (pressure switches, thermostats, flow indicators, etc.)
Anomalous noise	One or more teeth with: – dents or spillings – excessive flanks roughness	Consult Rossi
	Worn, faulty or badly lubricated bearings	Consult Rossi
	Taper roller bearings with excessive clearance	Consult Rossi
	Vibrations	Check the fastening and the bearings
Lubricant leaking from seal rings	Seal ring with worn, bakelized, damaged or false mounted seal lip	Replace seal ring (see ch. 8.3)
	Damaged raceway surface (scoring, rust, dent, etc.)	Restore the raceway
	Mounting position differs from the one stated on the name plate	Position the gear reducer correctly
Oil leaking from filler plug	Too much oil	Check oil level/quantity
	Incorrect mounting position	Check mounting position
	Inefficient vent valve	Clean/replace filler plug with vent valve
Low speed shaft not rotating even with high speed shaft/motor running	Broken key	Consult Rossi
	Completely worn gear pair	
Lubricant leaking from joints (covers or half-casing joints)	Defective oil seals	Consult Rossi
Water in the oil	Defective cooling coil or heat exchanger	Consult Rossi

Motor: see specific instructions.

NOTE

When consulting Rossi state:

- all data of gear reducer or gearmotor name plate;
- nature and duration of failure;
- when and under which conditions the failure occurred;
- during the warranty period, in order not to lose validity, do not disassemble nor tamper the gear reducer or gearmotor without approval by Rossi.

Notes

EN

Austria Habasit GmbH A-1234 Wien Phone +43 1 690 66 fax +43 1 690 66 10 e-mail: info.austria@habasit.com www.habasit.com	Finland Habasit AB S - 430 63 Hindås Phone +46 301 226 00 fax +46 301 226 01 e-mail: info@habasit.se www.habasit.se	Moldova Habasit GmbH A-1234 Wien Phone +43 1 690 66 fax +43 1 690 66 10 e-mail: info.austria@habasit.com www.habasit.com	Switzerland Habasit GmbH CH - Reinach - Basel Phone +41 61 715 15 75 fax +41 61 715 15 56 e-mail: info.ch@habasit.com www.habasit.ch
Australia Rossi Gearmotors Australia Pty. Ltd. AU - Perth WA Phone +61 8 94557399 fax +61 8 94557299 e-mail: info.australia@rossi-group.com www.rossigearmotors.com.au	France Rossi Motoréducteurs SARL F - Saint Priest Phone +33 472 47 79 30 fax +33 472 47 79 49 e-mail: info.france@rossi-group.com www.rossimotoreducteurs.fr	New Zealand Rossi Gearmotors New Zealand Ltd. NZ - Auckland Phone +61 9 263 4551 fax +61 9 263 4557 e-mail: info.nz@rossi-group.com www.rossigearmotors.com.au	Taiwan Habasit Rossi (Taiwan) LTD. TW - Taipei Hsien Phone +886 2 22670538 fax +886 2 22670578 e-mail: info.ha@habasit.com www.rossi-group.com
Benelux Habasit Netherlands B.V. NL - Nijkerk Phone +31 33 247 20 30 Fax: +31 33 246 15 99 e-mail: netherlands@habasit.com www.rossi-group.com	Germany Habasit GmbH D - Eppertshausen Phone +49 6071 / 969 - 0 fax +49 6071 / 969 -150 e-mail: rossi.germany@habasit.com www.habasit.de	Norway Habasit Norge A/S N - 1001 OSLO Phone +47 81 558 458 fax +47 22 301 057 e-mail: info@habasit.se www.habasit.no	Ucraina Habasit GmbH A-1234 Wien Phone +43 1 690 66 fax +43 1 690 66 10 e-mail: info.austria@habasit.com www.habasit.com
Bielorussia Habasit GmbH A-1234 Wien Phone +43 1 690 66 fax +43 1 690 66 10 e-mail: info.austria@habasit.com www.habasit.com	Hungary Habasit GmbH A-1234 Wien Phone +43 1 690 66 fax +43 1 690 66 10 e-mail: info.austria@habasit.com www.habasit.com	Portugal Rossi Motorreductores S.L. E - Viladecans (Barcelona) Phone +34 93 6377248 fax +34 93 6377404 e-mail: info.spain@rossi-group.com www.rossimotorreductores.es	United Kingdom Habasit Rossi Limited UK - Coventry Phone +44 2476 644646 fax +44 2476 644535 e-mail: info.uk@habasitrossi.com www.habasitrossi.co.uk
Canada Rossi Gearmotors Division of Habasit Canada Limited CA - Oakville, Ontario Phone +1 905 8274 131 fax +1 905 8252 612 e-mail: info.canada@habasit.com www.rossi-group.com	Iceland Habasit AB S - 430 63 Hindås Phone +46 301 226 00 fax +46 301 226 01 e-mail: info@habasit.se www.habasit.se	Russia Habasit GmbH A-1234 Wien Phone +43 1 690 66 fax +43 1 690 66 10 e-mail: info.austria@habasit.com www.habasit.com	United States Rossi Gearmotors A Division of Habasit America US - Suwanee Phone +1 800 931 2044 fax +1 678 288 3658 e-mail: rossi.info@us.habasit.com www.habasitamerica.com
China Rossi Gearmotors China P.T.I. CN - Shanghai Phone +86 21 3350 5345 fax +86 21 3350 6177 e-mail: info.china@rossi-group.com www.rossigearmotors.cn	India Rossi Gearmotors Pvt. Ltd. IN - Coimbatore Phone +91 422 262 7879 fax +91 422 262 7214 e-mail: info.india@rossi-group.com www.rossi-group.com	Spain Rossi Motorreductores S.L. E - Viladecans (Barcelona) Phone +34 93 6377248 fax +34 93 6377404 e-mail: info.spain@rossi-group.com www.rossimotorreductores.es	
Denmark Habasit AB DK - 3400 Hillerød Phone +45 48 28 80 87 fax +45 48 28 80 89 e-mail: info@habasit.se www.habasit.dk	Mexico Rossi Gearmotors A Division of Habasit America US - Suwanee Phone +1 800 931 2044 fax +1 678 288 3658 e-mail: rossi.info@us.habasit.com www.habasitamerica.com	Sweden Habasit AB S - 430 63 Hindås Phone +46 301 226 00 fax +46 301 226 01 e-mail: info@habasit.se www.habasit.se	

Responsabilità relative ai prodotti e al loro uso

Il Cliente è responsabile delle corretta scelta e dell'uso del prodotto in relazione alle proprie esigenze industriali e/o commerciali, salvo il caso in cui l'utilizzo sia stato raccomandato da personale tecnico Rossi, debitamente informato dal Cliente delle proprie necessità operative. In questo caso, tutti i dati necessari per la selezione dovranno essere comunicati fedelmente e per iscritto dal Cliente, riportati nell'ordine e confermati da Rossi. Il Cliente è sempre responsabile della sicurezza nell'ambito delle applicazioni del prodotto. Nella stesura del catalogo è stata dedicata la massima attenzione al fine di assicurare accuratezza delle informazioni. Tuttavia Rossi non può accettare responsabilità dirette o indirette per eventuali errori, omissioni o dati non aggiornati. A causa della costante evoluzione dello stato dell'arte, Rossi si riserva la possibilità di apportare in qualsiasi momento modifiche al contenuto della presente pubblicazione. Il responsabile ultimo della selezione del prodotto è il Cliente, salvo accordi diversi debitamente formalizzati per iscritto e sottoscritti dalle Parti.

Product liability, application considerations

The Customer is responsible for the correct selection and application of product in view of its industrial and/or commercial needs, unless the use has been recommended by technical qualified personnel of Rossi, who were duly informed about customer's application purposes. In this case all the necessary data required for the selection shall be communicated exactly and in writing by the Customer, stated in the order and confirmed by Rossi. The Customer is always responsible for the safety of product applications. Every care has been taken in the drawing up of the catalog to ensure the accuracy of the information contained in this publication, however Rossi can accept no responsibility for any errors, omissions or outdated data. Due to the constant evolution of the state of the art, Rossi reserves the right to make any modification whenever to this publication contents. The responsibility for the product selection is of the customer, excluding different agreements duly legalized in writing and undersigned by the Parties.

Rossi S.p.A.

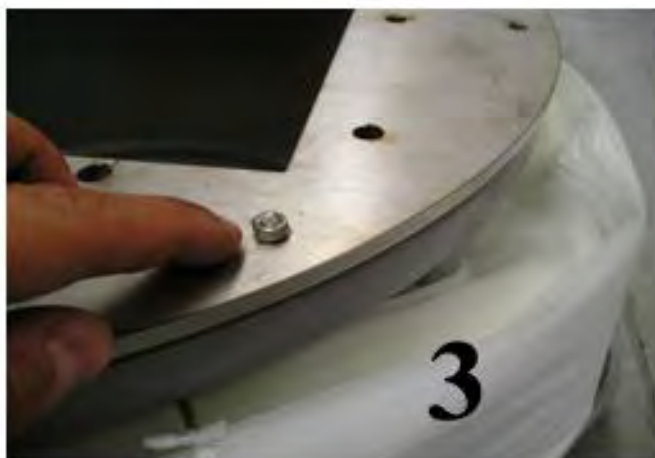
Via Emilia Ovest 915/A
41123 Modena - Italy
Phone +39 059 33 02 88
fax +39 059 82 77 74
e-mail: info@rossi-group.com
www.rossi-group.com

Registered trademarks
Copyright Rossi S.p.A.
Subject to alterations
Printed in Italy
Publication data
4090INS.VPR-it1210HQM
4090INS.VPR-en1210HQM

5**LONGOPAC BAGGING UNIT****USE OF THE CONTINUOUS BAGGING SYSTEM “LONGOPAC”**

COMPONENTS (see pictures below)

1. Longopac
2. Fixing Flange (just fixed on the outlet)



INSTALLATION / USE (see pictures below)

- Fix the Longopac 1 on the flange 2, with the screws supplied (See Pic. 3, 4 and 5).
- Open the Longopac (Pic.6)
- Take out the plastic bag (Pic. 7 and 8)
- Close the end of the plastic bag with a knot
- When the plastic bag reaches the required length it must be cut and the procedure repeated .

