



EVDRIVE03

Electronic expansion valves drivers



ENGLISH

USER MANUAL ver. 3.1

CODE 144EPDE314

Important

Important

Read this document carefully before installing and using the device and follow all the additional information; keep this document close to the device for future consultations.

The following symbols support the reading of the document:

💡 it indicates a suggestion

⚠ it indicates an additional information.

The device must be disposed according to the local legislation about the collection for electrical and electronic equipment.



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1 INTRODUCTION

1.1 Introduction

The drivers of the EVDRIVE03 series are devices studied for the management of bipolar stepper electronic expansion valves.

They are available in built-in and blind version (according to the model).

The user interface of the built-in versions consists of a LCD graphic display, of six buttons and guarantees an index of protection IP40.

The blind versions must be used with a remote user interface.

They can be powered both in alternating and in direct current (24 VAC/24... 37 VDC).

The drivers can work with the most common temperature probes (NTC and Pt 1000) and with the most common pressure transducers (0-20 mA, 4-20 mA, 0-5 V ratiometric and 0-10 V).

They have configurable digital inputs (enable the operation, change parameters set, backup module status, etc.) and a 5 res. A @ 250 VAC digital output (electromechanical relay) configurable as alarm output, solenoid valve or resynchronization valve.

Through the programming port it is possible to make the upload and the download of the configuration parameters (using the programming key EVKEY10); through this port (or the RS-485 one), it is also possible to connect the devices to the set-up software system Parameters Manager or to the plants monitoring and supervision one RICS (through a serial interface).

Through the CAN communication port (or the RS-485 one) it is possible to connect the devices to a controller or to a remote user interface instead.

Through the backup module EPD7BSC it is finally possible to close the valve in case of lack of power supply of the drivers.

Installation is on DIN rail.

Among the several functions one highlights the possibility to work both in stand alone mode and under the supervision of a controller, the management both of generic electronic expansion valves and of the most common valves Sporlan and Alco and the management of the backup probes.

1.2 Summarizing table of the main features and available models

The following table shows the main features of the devices and the available models.

The character " / " means the feature can be set through a configuration parameter.

Version (according to the model)				
built-in LCD				•
blind	•	•	•	
User interface				
71.0 x 128.0 mm (2.795 x 5.039 in; L x H), 4 DIN modules	•	•	•	•
128 x 64 pixel single colour (black with rearlighting through white LEDs) LCD graphic display				•
number of buttons				6
index of protection	IP20 IP40 the front	IP20 IP40 the front	IP20 IP40 the front	IP20 IP40 the front
Main connections				
extractable screw terminal blocks	•	•	•	•
Power supply				
24 VAC or 24... 37 VDC	•	•	•	•
Analog inputs				
analog input 1 (suction temperature backup probe / suction pressure backup probe)	NTC / Pt 1000 / 0-20 mA / 4-20 mA / 0-5 V	NTC / Pt 1000 / 0-20 mA / 4-20 mA / 0-5 V	NTC / Pt 1000 / 0-20 mA / 4-20 mA / 0-5 V	NTC / Pt 1000 / 0-20 mA / 4-20 mA / 0-5 V
analog input 2 (suction temperature backup probe / suction pressure backup probe)	NTC / Pt 1000 / 0-20 mA / 4-20 mA / 0-5 V	NTC / Pt 1000 / 0-20 mA / 4-20 mA / 0-5 V	NTC / Pt 1000 / 0-20 mA / 4-20 mA / 0-5 V	NTC / Pt 1000 / 0-20 mA / 4-20 mA / 0-5 V
analog input 3 (suction temperature probe)	NTC / Pt 1000	NTC / Pt 1000	NTC / Pt 1000	NTC / Pt 1000

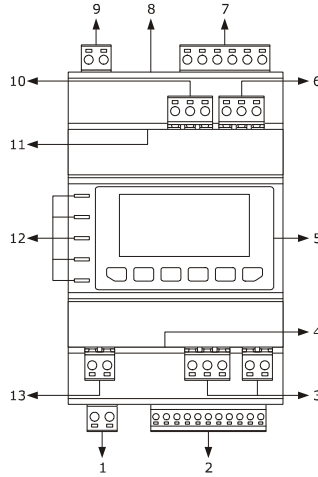
analog input 4 (suction pressure probe)	0-20 mA / 4-20 mA / 0-5 V / 0-10 V	0-20 mA / 4-20 mA / 0-5 V / 0-10 V	0-20 mA / 4-20 mA / 0-5 V / 0-10 V	0-20 mA / 4-20 mA / 0-5 V / 0-10 V
Free of voltage digital inputs				
digital input 1 (enable the operation / change parameters set / resynchronization command / backup module status)	•	•	•	•
digital input 2 (enable the operation / change parameters set / resynchronization command / backup module status)	•	•	•	•
High voltage digital inputs				
on-off switching (enable the operation / change parameters set / resynchronization command / backup module status)		•	•	•
Digital outputs (electromechanical relays; res. A @ 250 VAC)				
digital output 1 (alarm output / solenoid valve / resynchronization valve)	5 A	5 A	5 A	5 A
Communication ports				
CAN port with CANBUS communication protocol		•	•	•
RS-485 port with MODBUS communication protocol			•	•
programming port with MODBUS communication protocol	•	•	•	•
Codes				
codes	EPD4BX3	EPD4BC3	EPD4BF3	EPD4DF3

For further information look at chapter 11 "TECHNICAL DATA"; for further models please contact the EVCO sales network.

2 DESCRIPTION

2.1 Description

The following drawing shows the aspect of EVDRIIVE03.



The following table shows the meaning of the parts of EVDRIIVE03.

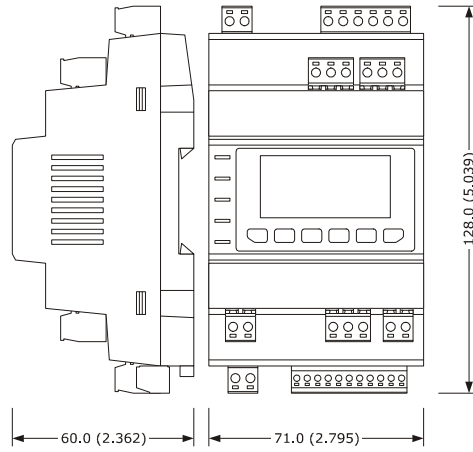
Part	Meaning
1	digital output
2	analog inputs and free of voltage digital inputs
3	CAN port (not available in model EPD4BX3)
4	CAN port line termination (not available in model EPD4BX3)
5	display and keyboard (not available in models EPD4BX3, EPD4BC3 and EPD4BF3)
6	reserved
7	bipolar stepper motor output
8	programming port
9	power supply
10	RS-485 port (not available in models EPD4BX3 and EPD4BC3)
11	RS-485 port line termination (not available in models EPD4BX3 and EPD4BC3)
12	signalling LEDs
13	high voltage digital input (not available in model EPD4BX3)

For further information look at the following chapters.

3 SIZE AND INSTALLATION

3.1 Size

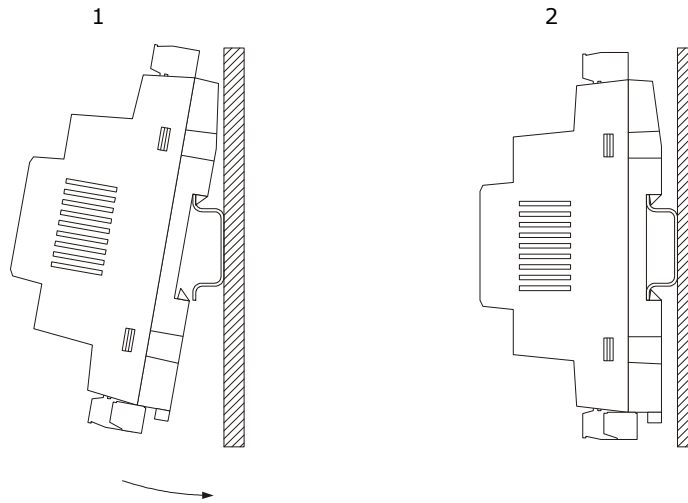
The following drawing shows the size of EVDRIVE03 (4 DIN modules); size in mm (in).



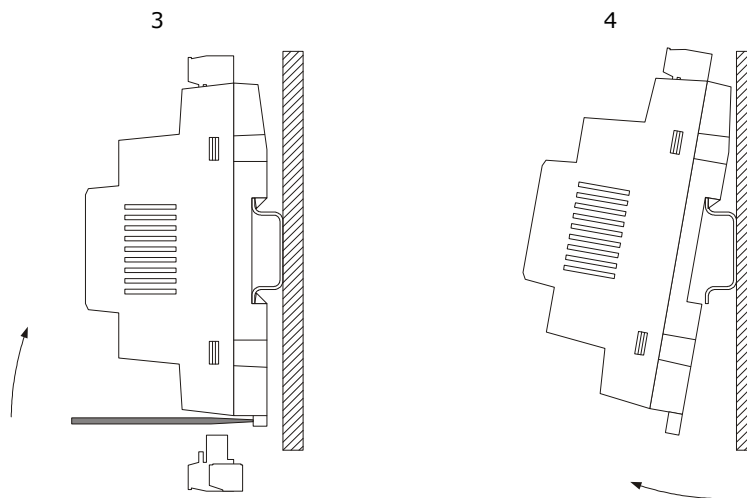
3.2 Installation

On DIN rail 35.0 x 7.5 mm (1.377 x 0.295 in) or 35.0 x 15.0 mm (1.377 x 0.590 in).

To install the device operate as shown in the following drawing.



To remove the device remove possible extractable screw terminal blocks plugged at the bottom first, then operate on the DIN rail clips with a screwdriver as shown in the following drawing.



To install the device again press the DIN rail clips to the end first.

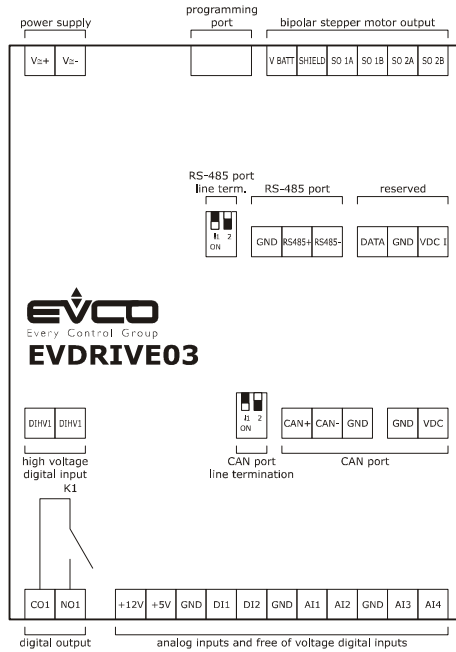
3.3 Additional information for the installation

- make sure the working conditions of the device (operating temperature, operating humidity, etc.) are in the limits indicated; look at chapter 11 "TECHNICAL DATA"
- do not install the device close to heating sources (heaters, hot air ducts, etc.), devices having big magnetos (big speakers, etc.), locations subject to direct sunlight, rain, humidity, dust, mechanical vibrations or bumps
- according to the safety legislation, the protection against possible contacts with the electrical parts must be ensured by a correct installation of the device; all the parts which ensure the protection must be fixed so that you can not remove them if not by using a tool.

4 ELECTRICAL CONNECTION

4.1 Meaning of the connectors

The following drawing shows the connectors of EVDRIVE03.



The following tables show the meaning of the connectors; for further information look at chapter 11 "TECHNICAL DATA".

Digital output

Electromechanical relay.

Terminal	Meaning
CO1	common digital output
NO1	normally open contact digital output

Analog inputs and free of voltage digital inputs

Part	Meaning
+12V	power supply 0-20 mA/4-20 mA/0-10 V transducers (12 VDC ±10%, 60 mA max.)
+5V	power supply 0-5 V ratiometric transducers (5 VDC ±5%, 40 mA max.)
GND	ground analog inputs and free of voltage digital inputs
DI1	digital input 1 (non optoisolated free of voltage contact; 5 V when not loaded, 3.3 mA when loaded)
DI2	digital input 2 (non optoisolated free of voltage contact; 5 V when not loaded, 3.3 mA when loaded)

GND	common analog inputs and free of voltage digital inputs
AI1	analog input 1 (which can be set via configuration parameter for NTC/Pt 1000 probes and for 0-20 mA/4-20 mA/0-5 V ratiometric transducers)
AI2	analog input 2 (which can be set via configuration parameter for NTC/Pt 1000 probes and for 0-20 mA/4-20 mA/0-5 V ratiometric transducers)
GND	common analog inputs and free of voltage digital inputs
AI3	analog input 3 (which can be set via configuration parameter for NTC/Pt 1000 probes)
AI4	analog input 4 (which can be set via configuration parameter for 0-20 mA/4-20 mA/0-5 V ratiometric/0-10 V transducers)

CAN port (not available in model EPD4BX3)

Non optoisolated CAN port, with CANBUS communication protocol.

Terminal	Meaning
CAN+	signal +
CAN-	signal -
GND	ground

- ⓘ - the maximum number of devices that can make a CAN network (32) depends on the bus load; the bus load depends on the baud rate of the CANBUS communication and on the kind of device in the network (for example: a CAN network can be made of a programmable controller, of four I / O expansions and of four user interfaces with baud rate 500,000 baud)
- ⚠ - connect the CAN port using a twisted pair
- do not connect more than four I / O expansions.

For the settings about the CAN port look at chapter 7 "CONFIGURATION".

Terminal	Meaning
GND	ground
VDC	power supply remote user interface (22... 35 VDC, 100 mA max.)

CAN port line termination (not available in model EPD4BX3)

Position microswitch 1 on position on (120 Ω , 0.25 W) to plug in the CAN port line termination (plug in the termination of the first and of the last element of the network).

**Reserved**

Reserved.

Bipolar stepper motor output

Terminal	Meaning
V BATT	backup power supply input
SHIELD	common bipolar stepper motor shielded cable
SO 1A	bipolar stepper motor coil 1
SO 1B	bipolar stepper motor coil 1
SO 2A	bipolar stepper motor coil 2
SO 2B	bipolar stepper motor coil 2

With reference to the previous table, the following one shows how to connect to EVDRIVE03 the most common electronic expansion valves Sporlan and Alco.

Terminal	Wire (color)		
	Sporlan SER, SEI and SEH	Alco EXL	Alco EX4, EX5, EX6, EX7 and EX8
SO 1A	green wire	blue wire	blue wire
SO 1B	red wire	yellow wire	brown wire
SO 2A	black wire	white wire	white wire
SO 2B	white wire	orange wire	black wire

Programming port

Non optoisolated programming port, with MODBUS communication protocol.

Power supply

Terminal	Meaning
V _≐ +	power supply device (not isolated; 24 VAC +10% -15%, 50/60 Hz ±3 Hz, 40 VA max. or 24... 37 VDC, 22 W max.)
V _≐ -	power supply device (not isolated; 24 VAC +10% -15%, 50/60 Hz ±3 Hz, 40 VA max. or 24... 37 VDC, 22 W max.)

- ⚠ - protect the power supply with a fuse rated 2 A-T 250 V
- if the device is powered in direct current, it is necessary to respect the polarity of the power supply voltage.

RS-485 port (not available in models EPD4BX3 and EPD4BC3)

Non optoisolated RS-485 port, with MODBUS communication protocol.

Terminal	Meaning
GND	ground
RS485+	D1 = A = + (terminal 1 of the transceiver)
RS485-	D0 = B = - (terminal 0 of the transceiver)

- ⚠ - connect the RS-485 MODBUS port using a twisted pair.
- For the settings about the RS-485 MODBUS port look at chapter 7 "CONFIGURATION".

RS-485 port line termination (not available in models EPD4BX3 and EPD4BC3)

Position microswitch 1 on position on (120 W, 0.25 W) to plug in the RS-485 port line termination (plug in the termination of the first and of the last element of the network).

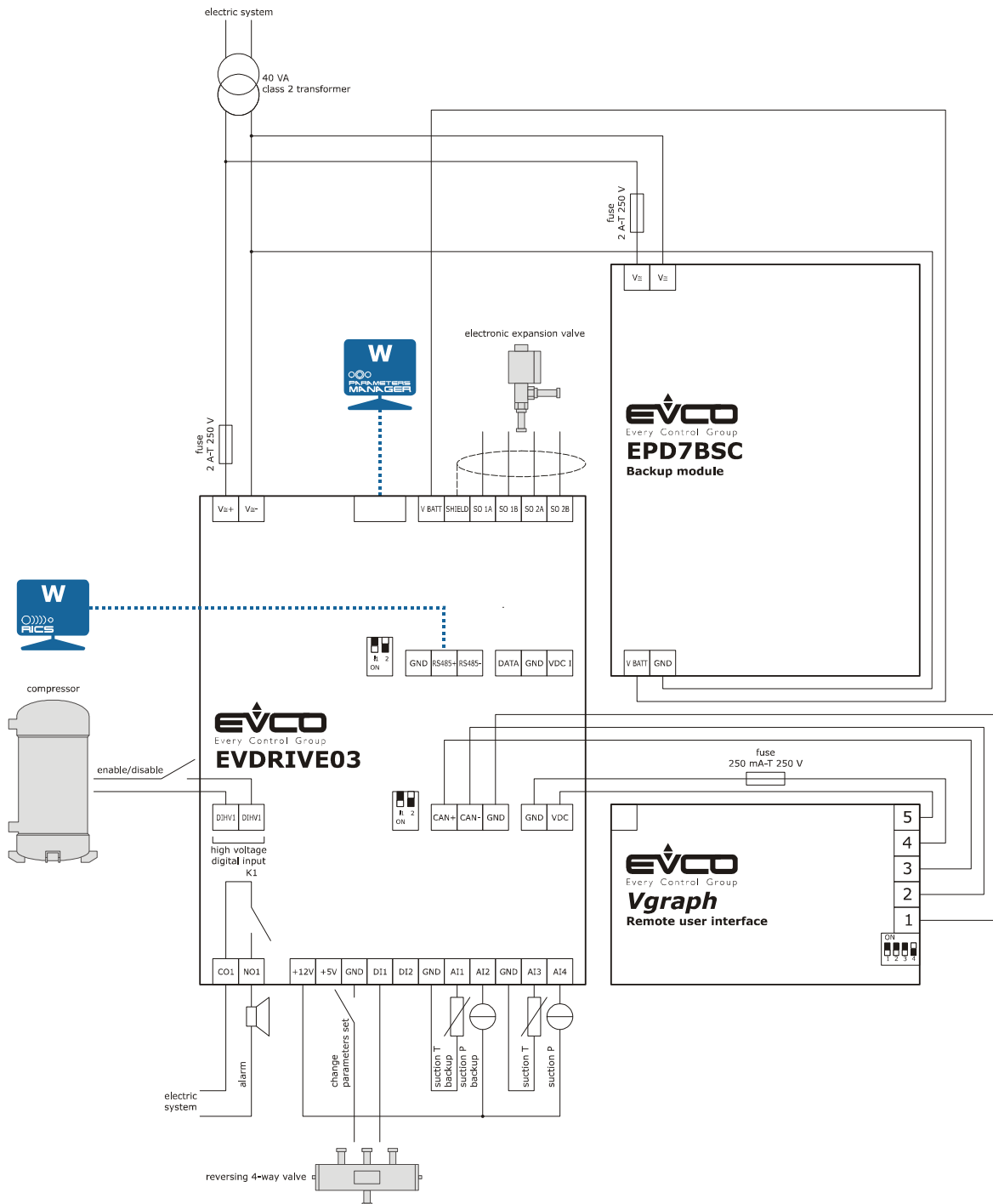
**High voltage digital input**

High voltage digital input (if present).

Part	Meaning
DIHV1	high voltage digital input (optoisolated contact; 115 VAC -10%... 230 VAC +10%)
DIHV1	high voltage digital input (optoisolated contact; 115 VAC -10%... 230 VAC +10%)

4.2 Example of electrical connection

The following drawing shows an example of electrical connection of EVDRIVE03.



Please note the power supply of EVDRIVE03 and that of EPD7BSC are not isolated one another: it is important to wire correctly the devices as indicated in the drawing.

4.3 Additional information for electrical connection

- do not operate on the terminal blocks of the device using electrical or pneumatic screwdrivers
- if the device has been moved from a cold location to a warm one, the humidity could condense on the inside; wait about an hour before supplying it
- make sure the power supply voltage, the electrical frequency and the electrical power of the device correspond to those of the local power supply; look at chapter 11 "TECHNICAL DATA"
- disconnect the power supply of the device before servicing it
- do not use the device as safety device
- for the repairs and for information about the device please contact the EVCO sales network.

5 USER INTERFACE







5.1 Preliminary information

EVDRIVE03 is available in built-in and blind version (according to the model).

The built-in versions can be programmed through the user interface, the blind ones must be used with a remote user interface (for example **Vgraph**): both the versions can be programmed through the set-up software system Parameters Manager or through the plants monitoring and supervision one RICS; look at chapter 7 "CONFIGURATION". Using the programming key EVKEY it is also possible to make the upload and the download of the configuration parameters.

5.2 Keyboard (not available in the blind versions)


The following table shows the meaning of the keyboard.

Button	Preset function
	cancel, hereinafter also called "button ESC"
	move to left, hereinafter also called "button LEFT"
	increase, hereinafter also called "button UP"
	decrease, hereinafter also called "button DOWN"
	move to right, hereinafter also called "button RIGHT"
	confirmation, hereinafter also called "button ENTER"

5.3 Signalling LEDs

The following table shows the meaning of the LEDs at the front of the device.

LED	Meaning
ON	LED power supply if it is lit, the device will be powered if it is out, the device will not be powered
STEP 1	LED stepper output 1 if it is lit, the valve will be stopped and completely closed if it flashes slowly, the valve will be stopped and completely open if it flashes quickly, the valve will be moving if it is out, the valve will be stopped and open in an intermediary position

<p>STEP 2</p>	<p>LED auxiliary</p> <p><u>if parameter Ph80 = 0, LED status</u></p> <p>if it is lit, the device will be working in superheating algorithm modality</p> <p>if it flashes slowly, the device will be working in manual or in debugger modality</p> <p>if it flashes quickly, the device will be working in analog positioner modality</p> <p>if it is out, the device will be in a status different from the ones related for parameter Ph80 = 0</p> <p><u>if parameter Ph80 = 1, LED MOP/LOP alarm</u></p> <p>if it flashes quickly, the MOP alarm will be running</p> <p>if it flashes slowly, the LOP alarm will be running</p> <p>if it is out, no MOP/LOP alarm will be running</p> <p><u>if parameter Ph80 = 2, LED high superheating/low superheating alarm</u></p> <p>if it flashes quickly, the high superheating alarm will be running</p> <p>if it flashes slowly, the low superheating alarm will be running</p> <p>if it is out, no high superheating/low superheating alarm will be running</p>
<p></p>	<p>LED alarm</p> <p>if it is on, an alarm will be running</p> <p>if it flashes slowly, it is necessary to disable/enable the device to the operation in order that the modification of the configuration parameters has effect</p> <p>if it flashes quickly, it is necessary to switch off/on the power supply of the device in order that the modification of the configuration parameters has effect</p> <p>if it is out, no alarm will be running</p>
<p>COM</p>	<p>LED communication</p> <p>if it is lit, a communication alarm device-controller will be running</p> <p>if it flashes slowly, the communication device-controller will not be completely correct</p> <p>if it flashes quickly, a communication alarm device-controller will be happened and the device (if foreseen) will be working in stand alone modality</p> <p>if it is out, the device will be working in stand alone modality or no communication alarm device-controller will be running</p>

6 OPERATION

6.1 Switch on and resynchronization

At switch-on and after a resynchronization, the fundamental parameters for moving the motor are acquired.

The parameters of pressure and temperature units of measure are loaded at switch-on, and, if necessary, is performed the conversion of all the parameters of pressure and temperature.

The parameters that are loaded only during the initialization phase, and therefore require a reset to be loaded, are referred to as manufacturer parameters (Manufacturer menu) and can be modified only in the stand-by state.

To select the desired valve, it is necessary to set the correct value in Valve selection (parameter Pi07).

Setting this parameter to a value of 0 (generic valve) means setting the parameters Pr50 and parameter Pr55 is required, with which it is possible to specify the value of each valve parameter.

With function "Copy selected to generic valve" it is possible to copy the default values of the selected valve into the ones of the generic valve, in order to use them as reference for possible modifications.

If a predefined valve is selected (parameter Pi07 > 0), all relevant parameters specific to that valve are loaded automatically from the flash memory.

The Driver type (parameter DrTy) used depends on the hardware, while the Stepper type (parameter StTy) depends on the motor to be utilised; currently, can be used only bipolar stepper motors.

The driving mode can be selected through parameter Driving mode selection (Pi01). If value 0 is selected (Pi01=0) the driving mode is automatically calculated to ensure the maximum speed according to the step rate of the selected valve. It means if the nominal step rate of the valve is higher than 625 steps/s, 8 microsteps/s will be used; while if the nominal step rate is lower than 625 steps/s, 16 microsteps/s will be used.

The driving mode can be shown through parameter DrvM.

The Valve duty cycle (parameter Pr45) represent the limit of continuous operating of the valve: limiting the continuous activity of the valve reduces the heating of same.

For example: setting Pr45 = 70% means for every 70 ms in which operational current is used, there will be 30 ms in which maintenance current will be applied on the valve.

If the parameter is set to 100%, this algorithm is deactivated.

Furthermore, this procedure applies only to the normal operation of the valve: all forced movements (for example synchronisation closure, positioning caused by probe errors or communication errors) are continuous until the target position is reached.

The valve is automatically resynchronized at every switch on.

During the resynchronization phase the valve is completely closed; the resynchronization is necessary to realign the physical position of the complete closure with the 0 step position.

During normal operation of the valve, it assumes the 0% position corresponds to the physical position defined by Minimum regulation steps, and that the 100% position corresponds to the physical position defined by Maximum regulation steps.

A resynchronization request can be signalled using various methods:

- rising edge on digital input DI2 (if DI2 is configured as "resynchronization command" and Enabling mode (parameter Pr06) is configured as "standalone")
- rising edge on Resynchro request (ResR) if Enabling mode (parameter Pr06) is configured as "network"
- internal request from the algorithm
- upon reaching the maximum limit of operational hours (Working hours, parameter Pr40), Resynchronization interval (parameter Pr41), if configured.

A resynchronization request is performed only when it is safe to do, so when the state is Stand-by: this means that a resynchronization request made when the valve is enabled is performed automatically only when it is disabled.

It is not currently possible to cancel a request.

The valve moves with a maximum velocity defined by the Stepping rate parameter.

The positioning speed depends on the operation mode:

- during resynchronization is used the maximum speed, but towards the end of the positioning is made a deceleration ramp
- in debug mode is used the speed of the Debug step rate (parameter Prd0)
- in manual mode and for all other positioning is used the maximum speed.

Using Limit valve opening (parameter Pr30) it is possible to adapt the valve to the application.

For example, for a valve with a maximum rating of 10 kW fitted to a machine with 7.5 kW, Pr30 would be set to 75%. So, if the request position target is 90%, the final real position of the valve may be 67.5% = 90 x 75% of the Maximum regulation steps.

The displayable variables for the current position and set-point in % are all referenced to the actual range of use of the valve (0 - Pr30%), while the position in steps is the real position.

6.2 Operating mode

6.2.1 Preliminary information

EVDRIVE03 implements a stepper motor control according to the state machine presented in the table here below (hereinafter the document will make reference to these status).

The state in which the algorithm is in may be readable in the FSM status (Finite State Machine, parameter Stat).

FSM	Meaning
0	initialization
1	synchronization wait
2	positioning wait
3	probe alarm
4	grid alarm
5	communication alarm
10	stand-by off
11	stand-by on
30	analog positioner
40	stabilization
41	start-up
42	algorithm selection
50	manual
51	debugger

60	reserved
61	SH algorithm

6.3 Stand-by and operation mode selection

At the end of the resynchronization operations the machine will enter the stand-by state, during which the installer parameters are loaded and configurations are checked.

In this status can be modified the installer parameters, that take effect immediately, and also the manufacturer parameters, that require a reset.

If there are no configuration errors, represented in the Alarm status (parameter AlSt) and Configuration warning (parameter CoWa), the valve can be enabled.

The operation mode is set using Main control type (Pcty), and when the valve is enabled:

if Pcty = 0 the system remains held in the Stand-by on (11)

if Pcty = 1... 5 the analog positioner (30) operation mode begins

if Pcty ≥ 6 start SH-algorithm or manual mode.

Please note regardless of the state of the enabled valve, disabling it will cause a positioning procedure using the value specified in stand-by position (parameter Pr20), after which the state is changed to Stand-by off (10).

6.4 Enabling EVDRIVE03

Excluding the automatic movements, it is necessary to enable the valve module EVDRIVE03 before moving it.

Enabling mode (parameter Pr06) configures the enabled features to be accepted.

When the valve module is to be used in standalone mode, an enable from digital input mode must be chosen (parameter Pr06 = 0 or Pr06 = 1).

The selection must be made based on the type of input to be used.

A typical application of the DIHV (parameter Pr06 = 1) mode is to connect it in parallel to the compressor, such that the valve is enabled along with it.

To enable the valve using digital inputs, it is necessary for these to be configured correctly, otherwise a configuration alarm will be generated.

In particular:

If Pr06 = 0: the DI1 input must be configured as enable > Ph11 = 1

If Pr06 = 1: the DIHV input must be configured as enable > Ph31 = 1

Selecting the values from 2 to 9 the valve can be enabled via serial port using MODBUS or CAN communication protocols: this selection must be made if a controller manages the EVDRIVE03.

Selecting values from 6 to 9, it is possible to operate the EVDRIVE03 in standalone mode if a communications fault occurs, in this case the DI1 or DI2 inputs must be configured as enable (parameter Ph11 = 1 or Ph21 = 1).

The enabling of the valve using a communication network requires system which ensures the EVDRIVE03 can determine whether the controller is still online: specifically, the module expects the controller updates the variable Enable valve command (parameter EnaV) periodically.

The Enable valve command (parameter EnaV) has different addresses according to the communication system chosen:

- CAN (Pr06 = 2 or Pr06 = 6)
- MODBUS RS-485 (Pr06 = 4 or Pr06 = 8): EnaV address = 1281
- MODBUS setting and programming port (Pr06 = 5 or Pr06 = 9): EnaV address = 12840.

6.5 Analog positioner control

The analog positioner mode permit to move the valve position linearly respect to the value applied to the active analog input.

Pcty = 01 > analog positioner on AI1 (0÷20mA)

Pcty = 02 > analog positioner on AI2 (4÷20mA)

Pcty = 03 > analog positioner on AI3 (0÷5V)

Pcty = 04 > analog positioner on AI4 (0÷10V)

Pcty = 05 > analog positioner on AI4 (Pia4).

To enter analog positioner mode, from the Stand-by, set the Main control type (parameter Pcty) with a value between 1 and 5, and enable the valve; if all the configuration is correct enter in Stand-by on (11), and then in the Analog positioner (30).

To exit the analog positioner mode, it is necessary to disable the valve, which will cause a positioning movement to the value specified in Stand-by position (parameter Pr20), before entering the Stand-by off (10).

The setting of Main control type (parameter Pcty) with a value between 1 and 4 impose to connect the indicated AI with the indicated probe, if the parameter Pcty = 5 impose to connect the probe with the AI4 and Ai4 probe usage (parameter Pia4) permit to choose the probe type.

The other three analog input are configured according to their respective Ai probe usage (parameter Pia).

6.6 Algorithm start-up

To enter algorithm mode, from the Stand-by off (10), set the Main control type (parameter Pcty) with a value greater or equal to 6, and enable the valve. If all the configuration is correct enter in Stand-by on (11) and then in the Stabilization (40), in which is performed a positioning to Stabilization position (parameter Pr09) and await expiration of Stabilization delay (parameter Pr08).

Then enter in Start-up (41), in which is performed a positioning to Start-up position (parameter Pc21 or Pp21), await Start-up delay (parameter Pc20 or Pp20) and finally enter in the Algorithm selection (42) in which evaluates Main control type (parameter Pcty) and Functioning mode (parameter Pr02).

This state also enables manual mode, debugger mode, or one of the available SH-algorithm.

The Functioning mode (parameter Pr02) defines the algorithm's operation mode, while Main control type (parameter Pcty) defines which algorithm can be used.

Specifically:

Pr02 = 0: enables control SH-algorithm defined by Main control type (parameter Pcty)

Pr02 = 1: enables manual algorithm, which permits movement of the valve to the position specified by Manual set-point position (parameter Pr03)

Pr02 = 2: actives a specific algorithm that moves the valve linearly up and down, at the desired step rate, between two specified positions.

Loading of Functioning mode (parameter Pr02) occurs every main cycle, and thus switching between the three algorithm operation modes occurs without forced intermediate positioning moves.

Note that Functioning mode (parameter Pr02) and Manual set-point position (parameter Pr03) are not saved into Eeprom, this means that from reset the valve starts always in automatic mode with Functioning mode Pr02 = 0 and Manual set-point position Pr03 = 0.

When enabled, the SH-algorithm automatically recalculates the optimal value of the Start-up position (parameter Pc21 or Pp21).

6.7 Manual mode

In manual mode (parameter Pr02 = 1), this permits movement of the valve and bringing it to the percentage value stored in Manual set-point position (parameter Pr03) using the maximum step rate. In this mode is active also the control algorithm, but its outputs are unused.

6.8 Debugging mode

The debugger feature is enabled when Pr02 = 2: the valve will move from a Debug minimum position (parameter Prd1) to a Debug maximum position (parameter Prd2) with the step rate defined by Debug step rate (parameter Prd0). Internally, the actuated step rate value is clamped to the maximum step rate of the selected valve.

7 CONFIGURATION

7.1 Preliminary information

A complete list of configuration parameters managed by the application is related in the following paragraph, each with a short code, brief description, default values and limits, measurement units (U), the menu in which they are accessed (M) and the notes.

The parameters are listed as shown when configuring the device using the set-up software system Parameters Manager or the plants monitoring and supervision one RICS.

When configuring a built-in version or a blind one (through a remote user interface) the parameters are listed in pages.

The menus are split into levels:

- U (User, without password)
- I (Installer, protected by first-level password)
- M (Manufacturer, protected by the second level password).

All the parameters in the User menu are freely modifiable and their modification is immediately applied. The Installer parameters are usually loaded by the application only when the machine is in the Stand-by off (10), and can be changed only in this state. The Manufacturer parameters are the most low-level and are usually loaded by the application only at the start-up, can be modified only in the Stand-by off (10) and requires a reset to load the new value.

The variable Parameters status (ParS), is dedicated to requesting a disable or reset state: the new parameters will thus can be loaded only when this signal went to 0.

The correct procedure for changing Installer and Manufacturer parameters is:

- disable the valve
- modify the parameters
- verify the Parameters status (ParS) value
- reset the board if requested by Parameters status (ParS).

7.1.1 Unit of measurements

Units of measurement used in the internal algorithm are Celsius (°C) and Kelvin (K) degrees in tenths for temperatures, and barG in hundreds for pressure.

For the convenience of the user, it is possible to set temperature and pressure parameters in the preferred unit of measurement, specifying the unit in parameters Pressure unit of measurement (Ph60) and Temperature unit of measurement (Ph61).

These parameters are acquired only during Initialization (0) phase at the reset , thus any changes to these parameters will take effect only after a reset.

Setting of the Ph60 and Ph61 parameters affects:

- the limits of certain parameters
- the measurement read from state variables
- the temperature and pressure parameters

The modify of the parameters of measurement unit will trigger automatic conversion of existing temperature and pressure parameters: the automatic conversion of all the pressure and temperature parameters is performed in the Initialization (0) at the start-up, and then the board reset is needed after unit of measure parameters change.

The correct procedure should be performed in this order:

- disable the valve
- change parameters Ph60 and/or Ph61
- reset the board
- check Parameters alarm bit in the Alarm status (AlSt)

- if parameters alarm is active, check and correct all the parameters of temperature and pressure, cancel the alarm leading to 1 bit 0 of the variable Command (Cmd), and then reset the EVDRIVE03
- if parameters alarm is cleared check ParS variable and if necessary, reset the board again.

It is recommended not to abuse the automatic conversion of the parameters: is a delicate function as its disruption can lead to the invalidation of all the memory parameters.

In addition, repetitive conversions lead to a subsequent loss of precision in the values.

The Internal unit of measure (UdM) indicates which units of measurements are actually used, since the parameters Ph60 and Ph61 may have been changed. After the reset and the automatic conversion the Internal unit of measure (UdM) mirrors the parameters.

Given that, as stated earlier, the internal algorithm work in Kelvin, Celsius and BarA, if the units of measurement chosen match these, no conversions are performed. If the user's units of measurements are in Fahrenheit and / or Psi, the following conversions are applied:

Param. in °F/R/PSI > val. in °C/K/bar > algorithm > val. out °C/K/bar > var. out °F/R/PSI.

7.2 Configuring a built-in version

To gain access to the user menu:

1. Make sure the power supply is switched on.
2. Move among the pages using the buttons as shown in the example here below:

to the installer menu

page 1

to select "Alarm status" and

page 3

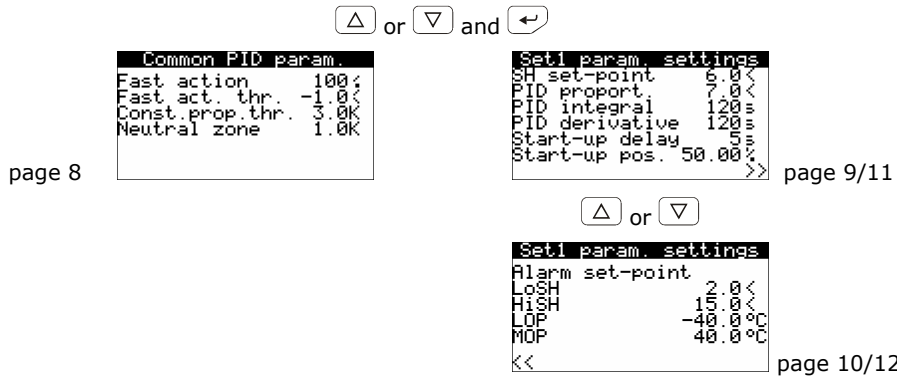
page 4

page 5

page 6

page 7

to the installer menu



The first five pages are dedicated to the end user and permit display of major features of the EVDRIVE03, any alarm messages, or whether it is necessary to resynchronise or reset the machine after changing parameters. In the third page, the fourth line is visible and blinking only if there is a request for resynchronization; the last line signalizes a request to disable (blinking "disable request") or a request to reset the board (negative blinking "reset request").

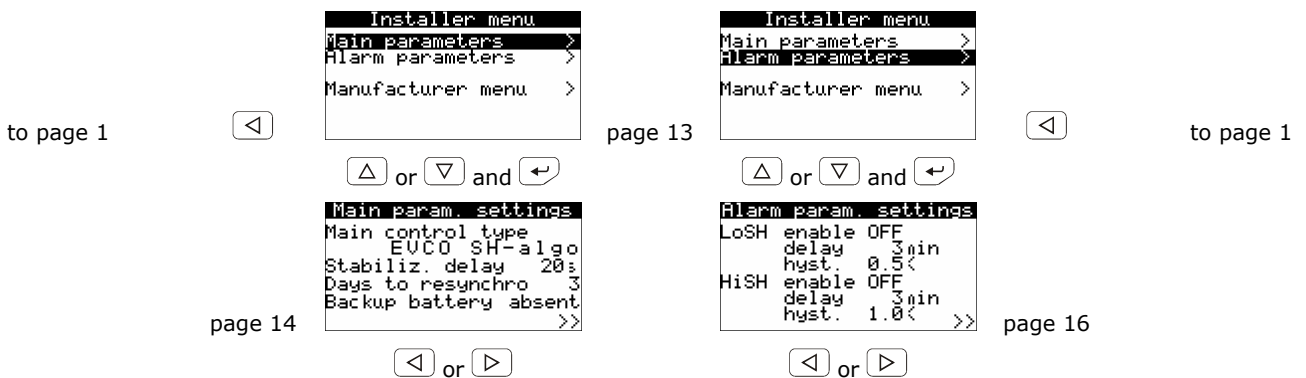
In the "User configuration" pages, some manual and debug mode functions are also available, including the direct setting of SH set-point to pass to the algorithm.

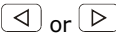
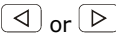
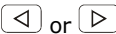
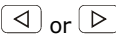
To modify a parameter operate as follows:

3. Make sure to have selected an "User configuration" page.
4. Press and release button UP or button DOWN to select a submenu.
5. Press and release button ENTER.
6. Press and release button UP or button DOWN to select the parameter.
7. Press and release button ENTER.
8. Press and release button UP or button DOWN to modify the value.
9. Press and release button ENTER to confirm the value.
10. Press and release button ESC over and over again to go back to the previous settings pages.

To gain access to the installer menu:

11. With reference to step 2, from page 1 press button LEFT (or from page 7 press button RIGHT).
12. Press and release button ENTER.
13. Press and release button UP or button DOWN over and over again to set level 1 password (according to the factory settings "10"; to change this value look at paragraph 7.6 "Main menu").
14. Press and release button ENTER again.
15. Move among the pages using the buttons as shown in the example here below:



page 15	<pre> Main param. settings Valve position on -Stand by 0% -Stabiliz. 0% -Probe alarm 0% -Comm. error 0% << </pre>	page 17
		
	<pre> Alarm param. settings LOP enable OFF delay 3min hyst. 1.0K << </pre>	page 18
		
	<pre> Alarm param. settings LowPressure enable OFF set point 1.003ar delay 3min hyst. 0.303ar << </pre>	page 19
		
	<pre> Alarm param. settings Communication enable OFF delay 30s << </pre>	page 20
		
	<pre> Alarm param. settings Power supply enable OFF delay 35s Backup battery enable OFF delay 35s << </pre>	page 21

These menus permit modification of most driver parameters.

In the "Main control parameters" the user can change the control type (analog positioner or SH algorithm), the algorithm sample time, the algorithm parameters set to be used and the parameters for each set, valve start-up position, valve position in case of probe or communication error, valve stand-by position, etc.

The "Alarm parameters" permit to enable or disable each alarm and settings the parameters.

To modify a parameter operate as follows:

16. Press and release button UP or button DOWN to select possible submenus.
17. Press and release button ENTER.
18. Press and release button UP or button DOWN to select the parameter.
19. Press and release button ENTER.
20. Press and release button UP or button DOWN to modify the value.
21. Press and release button ENTER to confirm the value.
22. Press and release button ESC over and over again to go back to the previous pages.

To gain access to the manufacturer menu:

23. With reference to step 15, from page 13 press button DOWN to select "**Manufacturer menu**".
24. Press and release button ENTER.
25. Press and release button ENTER again to set the password value.
26. Press and release button UP or button DOWN over and over again to set level 2 password (according to the factory settings "**20**"; to change this value look at paragraph 7.6 "Main menu").
27. Press and release button ENTER again.
28. Move among the pages using the buttons as shown in the example here below:

page 22

To make operative the manufacturer parameters is necessary to reset the EVDrive_3

◀ or ▶

page 23

```
Manufacturer menu
Plant & valve >
Digital I/O >
Analog input >
Communication >
Parameters backup >
Parameters restore >
```

△ or ▽

page 23

```
Manufacturer menu
Plant & valve >
Digital I/O >
Analog input >
Communication >
Parameters backup >
Parameters restore >
```

↩

page 24

```
Plant&Valve settings
Refriger. R-134A
Valve Sp SER-1.5
OpenLimit 100%
DutyCycle 100%
DrivingMo Full 2ph
Generic valve >>
```

◀ or ▶

page 25

```
Plant&Valve settings
Enable valve mode
DI1 or DI2
Frequency grid 50 Hz
Unit of measurement
temperature °C/K
pressure Bar
```

△ or ▽ and ↩

page 26

```
Generic valve setting
Minimum stp 200stp
Maximum stp 1596stp
Overdrive s 1600stp
Step rate 200stp/s
Max current 120mA
Hold current 0mA
```

page 23

```
Manufacturer menu
Plant & valve >
Digital I/O >
Analog input >
Communication >
Parameters backup >
Parameters restore >
```

△ or ▽

△ or ▽

page 23

```
Manufacturer menu
Plant & valve >
Digital I/O >
Analog input >
Communication >
Parameters backup >
Parameters restore >
```

page 23

```
Manufacturer menu
Plant & valve >
Digital I/O >
Analog input >
Communication >
Parameters backup >
Parameters restore >
```

↩

△ or ▽

page 27

```
Digital I/O settings
Relay funct. NO
DI1 None NO
DI2 None NO
DIHV None NO
Led p Status
```

page 28

```
Analog Input settings
Analog Input 1 >
Analog Input 2 >
Analog Input 3 >
Analog Input 4 >
Ts offset 0.0°C
Te offset 0.0°C
```

△ or ▽ and ↩

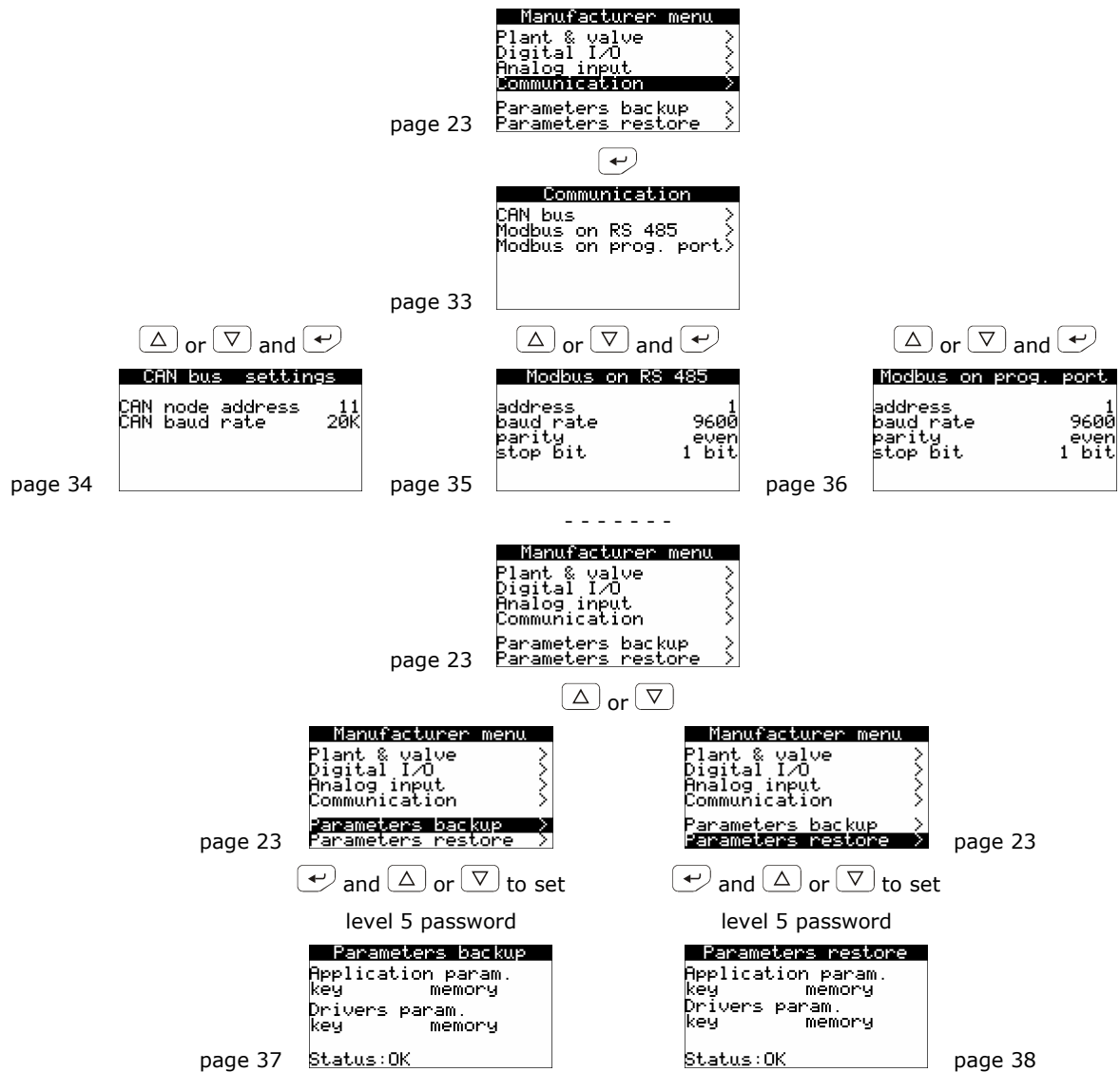
page 29/30/31/32

```
AI2 Settings
Usage Fe Primary
Type 4+20mA,0.5+0Barh
Scaling settings:
% axis: V axis:
Type0-20mA relative p
min 0.00 min 100
Max 20.00 Max 100
```

page 23

```
Manufacturer menu
Plant & valve >
Digital I/O >
Analog input >
Communication >
Parameters backup >
Parameters restore >
```

△ or ▽



The backup and restore functionalities are active only in Stand-by off (10). They are protected by the Level 5 password and permit to download a copy of the EVDRIVE03 application's parameters and/or the driver's parameters (calibrations of analogic inputs, communication settings, etc.) in the memory or in the parameters key.

The user can restore the parameters with the copy in the memory or in the parameters key.

To modify a parameter operate as follows:

29. Press and release button UP or button DOWN to select possible submenus.
30. Press and release button ENTER.
31. Press and release button UP or button DOWN to select the parameter.
32. Press and release button ENTER.
33. Press and release button UP or button DOWN to modify the value.
34. Press and release button ENTER to confirm the value.
35. Press and release button ESC over and over again to go back to the previous pages.

7.3 Configuring a blind version

The following procedures show an example of configuration of a blind version through an user interface (in the example **Vgraph**) and through its user interface.

For further information please consult the hardware manual of the user interface.

Operate as follows:

1. Switch off the power supply of the device and of the interface.
2. Connect the device to the interface through the CAN port; look at chapter 4 "ELECTRICAL CONNECTION".
3. Keep pressed 2 s buttons ESC and RIGHT.
4. Switch on the power supply of the device and of the interface.
5. When the display of the interface will show the following menu release buttons ESC and RIGHT.

Vgraph
Parameters
Contrast
CAN Network
Modbus
Info
<i>Real date and time</i>

6. Press and release button UP or button DOWN to select "**CAN Network**".
7. Press and release button ENTER.
8. Press and release button ENTER again to set the password value.
9. Press and release button DOWN over and over again to set "**-19**".
10. Press and release button ENTER again.
11. Set parameter *NW Node* using button UP or button DOWN to select the parameter and using button ENTER to modify and to confirm the value.

⚠ According to the factory setting the address of the CAN node of an electronic expansion valve driver has value **11** (therefore operate on the interface to set parameter *NW Node* to [1] 11).

12. Switch off the power supply of the interface.
13. Switch on the power supply of the interface.
14. Keep pressed 2 s buttons LEFT and ENTER: the display will show the following menu.

Network Status			
Loc	99	OK	> >
1	11	OK	> >
2	0	-	> >
3	0	-	> >
4	0	-	> >
5	0	-	> >

15. Press and release button UP or button DOWN to select the device.
16. Press and release button ENTER: the display will show page 1 of the device.
17. Operate as shown in paragraph 7.2 "Configuring a built-in version".

7.4 Configuring the device through the programming key EVKEY10

The following procedures show how to make the upload and the download of the configuration parameters through the programming key EVKEY10.

To copy the parameters from the device to the programming key EVKEY10 operate as follows:

1. Make sure the power supply is switched on.
2. Connect the key to the device; look at paragraph 10.1.4 "Connection to the device".
3. With reference to step 28 of the paragraph 7.2 "Configuring a built-in version", from page 37 press button UP or button DOWN to select "**key**" to copy the parameters in EVKEY10 or "**memory**" to copy the parameters in the internal memory of the device, belonging to the field "**Application param.**" to copy the application software parameters or belonging to the field "**Drivers param.**" to copy the configuration parameters.
4. Press and release button ENTER: the parameters will be copied (this operation usually takes a few seconds; the last line of the page provides information on the status of the process).
5. Disconnect the programming key.

To copy the parameters from the programming key EVKEY10 to the device operate as follows:

6. Make sure the power supply is switched on.
7. Connect the key to the device; look at paragraph 10.1.4 "Connection to the device".
8. With reference to step 28 of the paragraph 7.2 "Configuring a built-in version", from page 38 press button UP or button DOWN to select "**key**" to copy the parameters from EVKEY10 or "**memory**" to copy the parameters from the internal memory of the device, belonging to the field "**Application param.**" to copy the application software parameters or belonging to the field "**Drivers param.**" to copy the configuration parameters.
9. Press and release button ENTER: the parameters will be copied (this operation usually takes a few seconds; the last line of the page provides information on the status of the process).
10. Disconnect the programming key.

⚠ The copy of the parameters from the programming key EVKEY10 to the device is allowed on condition that the firmware of the devices coincides.

To quit the procedure operate as follows:

11. Press and release button ESC over and over again: possible modifications will not be saved.

7.5 Connecting the device through the set-up software system Parameters Manager

The following procedure shows how to connect the device to the set-up software system Parameters Manager.

For further information please consult the application manual of Parameters Manager.

Operate as follows:

1. To connect the device to the set-up software system Parameters Manager through the programming port, make sure to have the programming kit EVIF20TUXI; to connect the device to the set-up software system Parameters Manager through the RS-485 port, make sure to have the non optoisolated RS-485/USB serial interface EVIF20SUXI.
2. Switch off the power supply of the device.
3. Connect the kit (or the interface) to the Personal Computer; look at paragraph 10.2.4 (or 10.3.4) "Connection to the Personal Computer".

4. Switch on the power supply of the device.
5. Operate as related in the User manual of Parameters Manager.

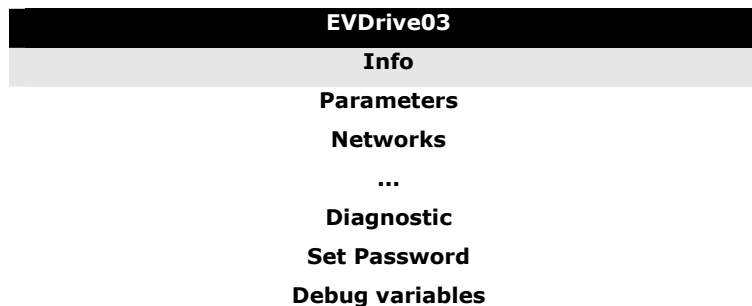
7.6 Main menu

The following procedures show how to gain access to the main menu.

The main menu provides information on the project, on the status of the inputs, allows to set the level's passwords, etc.

To gain access to the procedure operate as follows:

1. Make sure the power supply is switched on.
- 2.1 If you are using a built-in version, keep pressed 2 s buttons UP and DOWN: the display will show the following menu.
- 2.2 If you are using a blind version through a remote user interface (for example **Vgraph**), keep pressed 2 s buttons ESC and RIGHT: the display will show the following menu.



⚠ The access to some submenus is protected by password.

To gain access to a not protected submenu operate as follows:

3. Press and release button UP or button DOWN to select the submenu.
4. Press and release button ENTER.

To gain access a protected submenu operate as follows:

5. From step 2.1 or step 2.2, press and release button UP or button DOWN to select the submenu.
6. Press and release button ENTER.
7. Press and release button ENTER again to set the password value.
8. Press and release button DOWN over and over again to set "-19".
9. Press and release button ENTER again.

To modify a parameter operate as follows:

10. From step 4 or step 9, press and release button UP or button DOWN to select the parameter.
11. Press and release button ENTER.
12. Press and release button UP or button DOWN to modify the value.
13. Press and release button ENTER to confirm the value.
14. Press and release button ESC over and over again to go back to the previous pages.

To quit the procedure operate as follows:

15. Press and release button ESC over and over again: possible modifications will not be saved.

7.7 List of configuration parameters

The following table shows a full list of configuration parameters.

Par.	Min.	Mas.	Unità	Default	Menu	Control mode choice
Pcty	0	6	-----	6	I	main control type 0 = none 1 = analog positioner on AI1 (0-20 mA) 2 = analog positioner on AI2 (4-20 mA) 3 = analog positioner on AI3 (0-5 V) 4 = analog positioner on AI4 (0-10 V) 5 = analog positioner on AI4 6 = SH control
SetP	1	2	-----	1	U	SH parameters set selection 1 = parameters set n. 1 2 = parameters set n. 2
Par.	Min.	Mas.	Unità	Default	Menu	Parameters set n. 1
Pc01	3.0	25.0	K	6.0	User	SH setpoint
Pc02	1.0	3.0	K	2.0	User	LoSH setpoint
Pc03	10.0	40.0	K	15.0	User	HiSH setpoint
Pc04	-40.0	40.0	°C	-40.0	User	LOP temperature
Pc05	-40.0	40.0	°C	40.0	User	MOP temperature
Pc13	1.0	100.0	K	7.0	User	PID proportional band
Pc14	0	999	s	120	User	PID integral time
Pc15	0	999	s	120	User	PID derivative time
Pc20	1	255	s	5	Installer	start-up delay
Pc21	0.00	100.00	%	50.00	Installer	start-uo position
Par.	Min.	Mas.	Unità	Default	Menu	Parameters set n. 2
Pp01	3.0	25.0	K	6.0	User	SH setpoint
Pp02	1.0	3.0	K	2.0	User	LoSH setpoint
Pp03	10.0	40.0	K	15.0	User	HiSH setpoint

Pp04	-40.0	40.0	°C	-40.0	User	LOP temperature
Pp05	-40.0	40.0	°C	40.0	User	MOP temperature
Pp13	1.0	100.0	K	7.0	User	PID proportional band
Pp14	0	999	s	120	User	PID integral time
Pp15	0	999	s	120	User	PID derivative time
Pp20	1	255	s	5	Installer	start-up delay
Pp21	0.00	100.00	%	50.00	Installer	start-up position
Par.	Min.	Mas.	Unità	Default	Menu	Common SH algorithm
Fast	1	100	----	100	User	fast action
PNHi	0.0	25.0	K	1.0	User	neutral high threshold
Pcz	PNHi	25.0	K	3.0	User	constant proportional threshold
SHFi	0	255	100 ms	10	User	SH filter time constant
FaTh	-10.0	10.0	K	-1.0	User	fast action threshold
Par.	Min.	Mas.	Unità	Default	Menu	Protections and alarms
Pa01	0	1	----	0	Installer	enable communication alarm 1 = yes
Pa02	5	120	s	30	Installer	communication alarm delay
Pa10	0	1	----	0	Installer	enable LoSH alarm 1 = yes
Pa11	0.0	25.0	K	0.5	Installer	LoSH alarm hysteresis
Pa12	0	250	min	3	Installer	LoSH alarm delay
Pa20	0	1	----	0	Installer	enable HiSH alarm 1 = yes
Pa21	0.0	25.0	K	1.0	Installer	HiSH alarm hysteresis
Pa22	0	250	min	3	Installer	HiSH alarm delay

Pa30	0	1	-----	0	Installer	enable low pressure alarm 1 = yes
Pa31	0.00	45.00	barG	0.00	Installer	low pressure setpoint alarm
Pa32	0.20	1.00	barG	0.30	Installer	low pressure alarm hysteresis
Pa33	0	250	min	3	Installer	low pressure alarm delay
Pa40	0	1	-----	0	Installer	enable LOP alarm 1 = yes
Pa41	0.0	10.0	K	1.0	Installer	LOP alarm hysteresis
Pa42	0	250	min	3	Installer	LOP alarm delay
Pa50	0	1	-----	0	Installer	enable MOP alarm 1 = yes
Pa51	0.0	10.0	K	1.0	Installer	MOP alarm hysteresis
Pa52	0	250	min	3	Installer	MOP alarm delay
Pa53	0.0	25.0	K	7.0	Installer	MOP maximum dSH applicable
Pa54	0.0	25.0	K	8.0	Installer	MOP band
Pa55	0	255	10 s	15	Installer	MOP filter time constant
Pa56	0	255	min	10	Installer	MOP bypass delay
Pa70	0	1	-----	0	Installer	enable main power supply alarm 1 = yes
Pa71	0	60	s	1	Installer	main power supply alarm delay
Pa75	0	1	-----	0	Installer	enable backup battery alarm 1 = yes
Pa76	0	60	s	35	Installer	backup battery alarm delay
Par.	Min.	Mas.	Unità	Default	Menu	Valve and driver: refrigerant equipment

Pi00	0	17	-----	0	Manufact.	type of refrigerant 0 = R-22 1 = R-134A 2 = R-402A 3 = R-404A 4 = R-407A 5 = R-407C 6 = R-410A 7 = R-417A 8 = R-422A 9 = R-422D 10 = R-507A 11 = R-744 12 = R-438A 13 = R-401B 14 = R-290 15 = R-717 16 = R-1270 17 = R-32
Pi01	0	6	-----	1	Manufact.	driving mode selection 0 = automicrostepping 1 = full step 2 ph on 2 = full step 1 ph on 3 = half step 4 = microstepping 4 5 = microstepping 8 6 = microstepping 16

Pi07	0	28	-----	1	Costrutt.	valve selection 0 = generic valve 1 = Sporlan SER AA 2 = Sporlan SER A 3 = Sporlan SER B 4 = Sporlan SER C 5 = Sporlan SER D 6 = Sporlan SERI F 7 = Sporlan SERI G 8 = Sporlan SERI J 9 = Sporlan SERI K 10 = Sporlan SERI L 11 = Sporlan SEHI 175 12 = Sporlan SEHI 400 13 = Sporlan ESX 14 = Reserved 15 = Reserved 16 = Reserved 17 = Sporlan SER 1.5 to 20 18 = Sporlan SEI 30 19 = Sporlan SEI 50 20 = Sporlan SEH 100 21 = Sporlan SEI 0.5 to 11 22 = Alco EXM/EXL-246 23 = Alco EX4 a 6 24 = Alco EX7 25 = Alco EX8 26 = Danfoss ETS 12.5-25-50 27 = Danfoss ETS 100-250 28 = Danfoss ETS 400
Par.	Min.	Mas.	Unità	Default	Menu	Valve and driver: driver settings
Pr05	0.00	100.00	%	0.00	Installer	probe alarm position

Pr06	0	9	-----	0	Manufact.	<p>enabling mode</p> <p>0 = from free of voltage digital input DI1 or DI2 (stand alone)</p> <p>1 = from high voltage digital input (stand alone)</p> <p>2 = from CANBUS</p> <p>3 = reserved</p> <p>4 = from RS-485 port with MODBUS communication protocol</p> <p>5 = from MODBUS communication protocol via external serial interface</p> <p>6 = from CANBUS + free of voltage digital input DI1 as consequence of communication error</p> <p>7 = reserved</p> <p>8 = from RS-485 port with MODBUS communication protocol + free of voltage digital input DI1 as consequence of communication error</p> <p>9 = from MODBUS communication protocol via external serial interface + free of voltage digital input DI1 as consequence of communication error</p>
Pr08	0	255	s	1	Installer	stabilization delay
Pr09	0.00	100.00	%	50.00	Installer	stabilization position
Pr20	0.00	100.00	%	0.00	Installer	stand-by position
Pr30	50.00	100.00	%	100.00	Manufact.	limit valve opening
Pr40	0	9999	h	0	User	working hour (read only parameter)
Pr41	0	365	day	0	Installer	resynchronization interval 0 = disabled
Pr45	50	100	%	100	Manufact.	valve duty cycle
Pr48	0.00	100.00	%	0.00	Installer	communication error position
Par.	Min.	Mas.	Unità	Default	Menu	Valve and driver: generic valve
Pr50	0	Pr51	step	200	Manufact.	minimum regulation steps

Pr51	Pr50	9999	step	1596	Manufact.	maximum regulation steps
Pr52	Pr51	9999	step	1600	Manufact.	overdrive steps
Pr53	25	1000	step/s	200	Manufact.	stepping rate
Pr54	0	1000	mA	120	Manufact.	operating phase current
Pr55	0	1000	mA	0	Manufact.	holding phase current
Par.	Min.	Mas.	Unità	Default	Menu	Valve and driver: debug
Prd0	25	1000	step/s	25	User	debug step rate
Prd1	0.00	Prd2	%	0.00	User	debug minimum position
Prd2	Prd1	100.00	%	100.00	User	debug maximum position
Par.	Min.	Mas.	Unità	Default	Menu	Valve and driver: backup battery
Pb01	0	1	----	0	Installer	backup battery 1 = present
Par.	Min.	Mas.	Unità	Default	Menu	Valve and driver: digital I/O settings and various
Ph01	0	8	----	0	Manufact.	digital output DO1 function 0 = disabled 1 = any alarm 2 = probe errors 3 = following low SH alarms 4 = following MOP alarms 5 = following valve alarm 6 = used for solenoid valve 7 = alarms + used for solenoid valve 8 = valve resynchronization signal is necessary
Ph02	0	1	----	0	Manufact.	relay logic 0 = normally unexcited 1 = normally excited
Ph10	0	1	----	0	Manufact.	free of voltage digital input DI1 logic 0 = normally open 1 = normally closed

Ph11	0	4	----	1	Manufact.	free of voltage digital input DI1 function 0 = none 1 = enable/disable valve 2 = change parameters set 3 = resynchronization request 4 = backup battery status
Ph20	0	1	----	0	Manufact.	free of voltage digital input DI2 logic 0 = normally open 1 = normally closed
Ph21	0	4	----	2	Manufact.	free of voltage digital input DI2 function 0 = none 1 = enable/disable valve 2 = change parameters set 3 = resynchronization request 4 = backup battery status
Ph30	0	1	----	0	Manufact.	high voltage digital input logic 0 = normally open 1 = normally closed
Ph31	0	4	----	0	Manufact.	high voltage digital input DIHW function 0 = none 1 = enable/disable valve 2 = change parameters set 3 = resynchronization request 4 = backup battery status
Ph60	0	1	----	0	Manufact.	pressure unit of measurements 0 = barG 1 = psiG
Ph61	0	1	----	0	Manufact.	temperature unit of measurements 0 = °C / K 1 = °F / R
Ph70	0	1	----	0	Manufact.	frequency grid 0 = 50 Hz 1 = 60 Hz
Ph80	0	2	----	0	Manufact.	LED "STEP 2" function 0 = status 1 = LOP alarms + MOP alarms 2 = Lo SH alarms + Hi SH alarms
Par.	Min.	Mas.	Unità	Default	Menu	Probe settings: analog input AI1

Piu1	0	4	-----	1	Manufact.	analog input AI1 function 0 = not used 1 = suction temperature backup probe 2 = suction pressure backup probe
Pia1	1	30	-----	1	Manufact.	analog input AI1 probe type 1 = NTC probe 6 = Pt 1000 probe 10 = 4-20 mA transducer (0.5 - 8 barA) 11 = 4-20 mA transducer (0 - 30 barA) 20 = 0-5 V (0 - 7 barG) 21 = 0-5 V (0 - 25 barG) 22 = 0-5 V (0 - 60 barG) 30 = scaling
Par.	Min.	Mas.	Unità	Default	Menu	Probe settings: analog input AI1 scaling
P1Xty	0	2	-----	0	Manufact.	X type 0 = 0-20 mA 1 = 4-20 mA 2 = 0-5 V
P1XM	P1Xm	0:20.00 1:20.00 2:5.00	-----	20.00	Manufact.	X max value
P1Xm	0:0.00 1:4.00 2:0.00	P1XM	-----	0.00	Manufact.	X min value
P1Tty	0	1	-----	0	Manufact.	Y type 0 = barG 1 = barA
P1YM	P1Ym	300.00	barG/barA	1.00	Manufact.	Y max value
P1Ym	- 300.00	P1YM	barG/barA	0.00	Manufact.	Y min value
Par.	Min.	Mas.	Unità	Default	Menu	Probe settings: analog input AI2
Piu2	0	2	-----	0	Manufact.	analog input AI2 function 0 = not used 1 = suction temperature backup probe 2 = suction pressure backup probe

Pia2	1	30	-----	1	Manufact.	analog input AI2 probe type 1 = NTC probe 6 = Pt 1000 probe 10 = 4-20 mA transducer (0.5 - 8 barA) 11 = 4-20 mA transducer (0 - 30 barA) 20 = 0-5 V (0 - 7 barG) 21 = 0-5 V (0 - 25 barG) 22 = 0-5 V (0 - 60 barG) 30 = scaling
Par.	Min.	Mas.	Unità	Default	Menu	Probe settings: analog input AI2 scaling
P2Xty	0	2	-----	0	Manufact.	X type 0 = 0-20 mA 1 = 4-20 mA 2 = 0-5 V
P2XM	P2Xm	0:20.00 1:20.00 2:5.00	-----	20.00	Manufact.	X max value
P2Xm	0:0.00 1:4.00 2:0.00	P2XM	-----	0.00	Manufact.	X min value
P2Yty	0	1	-----	0	Manufact.	Y type 0 = barG 1 = barA
P2YM	P2Ym	300.00	barG/barA	1.00	Manufact.	Y max value
P2Ym	- 300.00	P2YM	barG/barA	0.00	Manufact.	Y min value
Par.	Min.	Mas.	Unità	Default	Menu	Probe settings: analog input AI3
Piu3	3	3	-----	3	Manufact.	analog input AI3 function 3 = suction temperature probe
Pia3	1	6	-----	1	Manufact.	analog input AI3 probe type 1 = NTC probe 6 = Pt 1000 probe
Par.	Min.	Mas.	Unità	Default	Menu	Probe settings: analog input AI4

Piu4	4	4	----	4	Manufact.	analog input AI4 function 4 = suction pressure probe
Pia4	10	30	----	10	Manufact.	analog input AI4 probe type 10 = 4-20 mA transducer (0.5 - 8 barA) 11 = 4-20 mA transducer (0 - 30 barA) 20 = 0-5 V (0 - 7 barG) 21 = 0-5 V (0 - 25 barG) 22 = 0-5 V (0 - 60 barG) 30 = scaling
Par.	Min.	Mas.	Unità	Default	Menu	Probe settings: analog input AI4 scaling
P4Xty	0	3	----	0	Manufact.	X type 0 = 0-20 mA 1 = 4-20 mA 2 = 0-5 V 3 = 0-10 V
P4XM	P4Xm	0:20.00 1:20.00 2:5.00 3:10.00	----	20.00	Manufact.	X max value
P4Xm	0:0.00 1:4.00 2:0.00 3:0.00	P4XM	----	0.00	Manufact.	X min value
P4Yty	0	1	----	0	Manufact.	Y type 0 = barG 1 = barA
P4YM	P4Ym	300.00	barG/barA	1.00	Manufact.	Y max value
P4Ym	- 300.00	P4YM	barG/barA	0.00	Manufact.	Y min value
Par.	Min.	Mas.	Unità	Default	Menu	Probe settings: offset
OfsTs	-10.0	10.0	K	0.0	User	suction temperature offset
OfsTe	-10.0	10.0	K	0.0	User	suction pressure (converted into temperature) offset
Par.	Min.	Mas.	Unità	Default	Menu	Communication settings

Mb0a	1	247	-----	1	Manufact.	MODBUS RS-485 port address
Mb0p	0	2	-----	2	Manufact.	MODBUS RS-485 port parity 0 = none 1 = odd 2 = even
Mb0b	0	4	-----	3	Manufact.	MODBUS RS-485 port baud rate 0 = 1,200 1 = 2,400 2 = 4,800 3 = 9,600 4 = 19,200
Mb0s	0	1	-----	0	Manufact.	MODBUS RS-485 port stop bit 0 = 1 bit 1 = 2 bit
Mb1a	1	1	-----	1	Manufact.	MODBUS prog port address
Mb1p	2	2	-----	2	Manufact.	MODBUS prog port parity 0 = none 1 = odd 2 = even
Mb1b	4	4	-----	4	Manufact.	MODBUS prog port baud rate 0 = 1,200 1 = 2,400 2 = 4,800 3 = 9,600 4 = 19,200
Mb1s	0	0	-----	0	Manufact.	MODBUS prog port stop bit 0 = 1 bit 1 = 2 bit
CANn	1	127	-----	11	Manufact.	CAN node address
CANb	0	4	-----	1	Manufact.	CAN baud rate 0 = 10K 1 = 20K 2 = 50K 3 = 125K 4 = 500K
Par.	Min.	Mas.	Unità	Default	Menu	Command

Pr02	0	2	-----	0	User	functioning mode 0 = SH-ALGORITHM 1 = manual mode 2 = debug functionality
Pr03	0.00	100.00	%	0.00	User	manual setpoint position (only if Pr02 = 1)
ResR	0	1	-----	0	User	resynchronization request
EnaV	0	1	-----	0	User	enable valve command (RS-485 or external MODBUS) 0 = disable valve 1 = enable valve
Cmd	0	65535	-----	0	User	command (b0: 0 -> 1 reset parameter alarm; Cmd: x -> 0zBx reset application)
Par.	Min.	Mas.	Unità	Default	Menu	Status
UdM	-----	-----	-----	-----	User	internal unit of measure b0: 0: pressure in bar 1: pressure in psi b1: 0: temperature in °C/K 1: temperature in °F/R b2: 0: conversion ok 1: conversion in progress or halted
DrvM	0	5	-----	-----	User	driving mode 0 = full step 2 ph on 1 = full step 1 ph on 2 = half step 3 = microstepping 4 4 = microstepping 8 5 = microstepping 16

Stat	0	61	-----	-----	User	<p>FSM status</p> <ul style="list-style-type: none"> 0 = initialization 1 = synchronization wait 2 = positioning wait 3 = probe alarm 4 = grid alarm 5 = communication alarm 10 = stand-by off 11 = stand-by on 30 = analog positioner 40 = stabilization 41 = start-up 42 = algorithm selection 50 = manual 51 = debugger 60 = reserved 61 = SH algorithm
AlSt	-----	-----	-----	-----	User	<p>alarm status</p> <ul style="list-style-type: none"> b0: EEPROM alarm b1: configuration alarm b2-3: communication status b4-7: probe alarm b8: power fail b9: backup battery alarm b10: algorithm alarm b11: reserved b12: parameters conversion failed
AlgS	-----	-----	-----	-----	User	<p>SH algorithm status</p> <ul style="list-style-type: none"> b0: measure not acquired b1: algorithm halted b2: bypass algorithm (manual) b3: LoSH algorithm is running b4: LoSH alarm b5: HiSH algorithm is running b6: HiSH alarm b7: LOP algorithm is running b8: LOP alarm b9: MOP algorithm is running b10: MOP alarm b11: LP b12: LP alarm

CoWA	0	21	-----	-----	User	configuration warnin 0 = correct configuration 1 = incorrect configuration for start-up 2 = invalid value for parameter Pia1 3 = invalid value for parameter Pia2 4 = invalid value for parameter Pia3 5 = invalid value for parameter Pia4 6 = Piu1 configuration matches other PiuX 7 = Piu2 configuration matches other PiuX 8 = Piu3 configuration matches other PiuX 9 = incorrect configuration Piu4 10 = mismatch between Pia1 and Piu1 11 = mismatch between Pia2 and Piu2 12 = mismatch between Pia3 and Piu3 13 = mismatch between Pia4 and Piu4 14 = awaiting configuration AI1 15 = awaiting configuration AI2 16 = awaiting configuration AI3 17 = awaiting configuration AI4 18 = awaiting analog configurations 19 = error writing Xmax probe 4 scaling 20 = error writing Xmax probe 4 scaling 21 = no primary temperature or pressure probe configured
PAtt	0.00	100.00	%	-----	User	actual valve position
PAtP	-----	-----	step	-----	User	actual valve position step
Psp	0.00	100.00	%	-----	User	target position
EnaS	0	1	-----	-----	User	enable valve status 0 = valve not enabled 1 = valve enabled
ResS	0	1	-----	-----	User	resynchronization request status 0 = no request 1 = request reserved
IhoS	0	1	-----	-----	User	holding current status 0 = operating phase current 1 = holding phase current
Te	-----	-----	°C	-----	User	Te (evaporation temperature)

Pe	-----	-----	barG	-----	User	Pe (evaporation pressure)
Ts	-----	-----	°C	-----	User	Ts (suction temperature)
SH	-----	-----	K	-----	User	SH
SpSH	-----	-----	K	-----	User	SH setpoint
SetS	1	2	-----	-----	User	selected SH parameters set
PidP	-----	-----	%	-----	User	PID setpoint position output
ParS	0	2	-----	-----	User	parameters status bit0: disable the valve to accept new parameters bit1: reset the board to accept new parameters
SRat	-----	-----	step/s	-----	User	actual value step rate
Pnum	-----	-----	-----	-----	User	project number
Pvar	-----	-----	-----	-----	User	project variation 0 = AA 1 = AB 2 = AC etc.
Pver	-----	-----	-----	-----	User	project version
Prev	-----	-----	-----	-----	User	project revision

8 SERIAL COMMUNICATION

8.1 Preliminary information

It is possible to control the EVDRIVE03 driver by connecting it to a controller.

The controller sends information to the driver necessary for its correct functioning, and the driver responds with its internal states, such as (for example) the pressure and temperature measurements, alarms, certain parameters, etc.

The connection methods available on the EVDRIVE03 are CANBUS, MODBUS RS-485, and MODBUS on the setting and programming port, according to the model.

The protocol to be used for communication with the controller must be selected via parameter Enabling mode (Pr06).

8.2 CANBUS serial communication

The EVCO controllers primarily use a protocol based on CANBUS for communication with controllable systems.

The exchange of data is based on a list of variables or parameters that the controller may send to the driver, and a list of variables the driver sends to the controller to provide its state data.

8.3 MODBUS serial communication

Serial communication via the programming and RS-485 port may use the MODBUS protocol. The accessible variables and parameters are those shown in the tables in the section "Configuration". These same tables also include MODBUS addresses (base 1).

The same rules covered earlier for the communication alarm management also apply to the valve Enable valve command (EnaV) (see "Communication error").

The port configuration can be performed using dedicated configuration pages on the LCD display (for the built-in versions) or **Vgraph** (for the blind versions used with a remote user interface).

The default setting for each MODBUS communication port is 9600 bps, even parity, 1 stop bit.

9 ALARMS AND ERRORS

9.1 Alarms and errors

The system supports a series of alarms related to both the system (memory, probes, communication, configuration, etc.), and the regulation algorithm (LoSH, HiSH, LOP, MOP, LowPressure).

All the alarms, except the parameters alarm (EPar), are automatic, this means that they will be cancelled automatically once the cause of the alarm is removed.

The presence of an alarm status is signalled using the LED interface and using relays, if suitably configured.

The alarm status is always available in the Alarm status (AlSt), Configuration warning (CoWA) and Algorithm status (AlgS).

Alarm Status	Short Code	Alarm description	Parameters
Bit 0	EHD1	Memory error	--
Bit 1	EHD2	Configuration error	
Bit 2,3	Ecom	Communication error	Pa01, Pa02, Pr48
Bit 4	EPr1	Probe Ai1 error	Pr05
Bit 5	EPr2	Probe Ai2 error	Pr05
Bit 6	EPr3	Probe Ai3 error	Pr05
Bit 7	EPr4	Probe Ai4 error	Pr05
Bit 8	PSer	Power failure	Pa70, Pa71, Pb01
Bit 9	Ebat	Backup battery error	Pa75, Pa76 , Pb01, Ph21, Ph20
Bit 10	Ealg	Algorithm status	Pa11, Pa12, Pa20, Pa21, Pa22, Pa30, Pa31, Pa32, Pa33, Pa40, Pa41, Pa42, Pa50, Pa51, Pa52
Bit 12	Epar	Parameters error	--

9.2 Memory error

A memory error occurs when it is not possible to access data stored in the EEPROM memory: it is not therefore possible to access the parameter values stored on it, so they will assume default values from flash memory. It is also not possible to store new parameter values.

This alarm can be occurred if the automatic conversion procedure of the temperature and/or pressure parameters is halted. In this case also the parameters alarm is set and is necessary to reload the default parameters from the flash memory to clear the memory alarm.

9.3 Configuration error

In the Stand-by off state is checked the correctness and the congruence of the parameters. If the configuration is not correct, an alarm is generated, signalled by bit 1 of Alarm status (AlSt). To determine the significance of this single bit Configuration warning (CoWA) contains the error code generated during the parameter verification process.

Code	Reason	What to do
0	Correct configuration (no error)	-
1	Pr06 value invalid, or if Pr06 = 0, Ph11 not set to enable valve, or, if Pr06 = 1, Ph31 not set to enable valve.	Check parameters Pr06, Ph11, Ph31
2	Invalid value for parameter PIA1	Set parameter to a valid value
3	Invalid value for parameter PIA2	

4	Invalid value for parameter PIA3	
5	Invalid value for parameter PIA4	
6	PIu1 configured as another PIux	Parameters Piu1, Piu2, Piu3 and Piu4 must each
7	PIu2 configured as another PIux	have different values, or null.
8	PIu3 configured as another PIux	Checked only if Pcty \geq 6
9	PIu4 configured as another PIux	
10	Contradiction between analog input type (Pia1) and its utilization (Piu1)	Check parameters Piax and PIux.
11	Contradiction between analog input type (Pia2) and its utilization (Piu2)	Temperature is measured using probes of type NTC, pt1000, or scaling; pressure
12	Contradiction between analog input type (Pia3) and its utilization (Piu3)	is measured using current, tension or scaling probes.
13	Contradiction between analog input type (Pia4) and its utilization (Piu4)	Checked only if Pcty \geq 6
14	Awaiting AI1 configuration	Wait
15	Awaiting AI2 configuration	Wait
16	Awaiting AI3 configuration	Wait
17	Awaiting AI4 configuration	Wait
18	Awaiting analog inputs configurations	Wait
19	Limit error Xmax probe scaling	
20	Limit error Xmax probe scaling	
21	No AI configured for primary temperature	Check PIu1, PIu2, PIu3 and PIu4 parameters or pressure probe input and ensure one is dedicated to the primary temperature probe, and another to the primary pressure probe. Checked only if Pcty \geq 6

9.4 Communication error

A communication error is signalled only if a suitable communication mode is selected ($Pr06 \geq 2$), and the communication alarm is active ($Pa01 = 1$). Under these conditions, the driver expects the controller to periodically refresh the Enable valve command (EnaV).

If the refresh does not happen for more than half the time set in Communication alarm delay ($Pa02$), a warning is given. If the refresh does not happen for more than the time set in Communication alarm delay ($Pa02$), the communication is considered lost and communication alarm is set.

Management of this alarm depends on the mode selected. If $Pr06 = 2 \div 5$, a communication alarm state will cause the valve to be forced to the position determined by Communication error position ($Pr48$), and will then enter the Communication alarm (5) until the positioning process has completed and the communication start again. If $Pr06 = 6 \div 9$, a communication alarm status will place the valve into standalone mode, and DI1 enable the valve.

When the communication alarm is cleared, the valve will automatically return to the online mode.

The significance of bit 3 and 2 of Alarm status (AlSt) are shown in the following table:

bit3	bit2	Significance
0	0	No communication alarm
0	1	Warning
1	0	Communication alarm in standalone mode
1	1	Communication alarm

9.5 Probe error

The probe alarm state is monitored every main cycle and is shown in bits 4÷7 of Alarm status (AlSt) and also signalled by the relay, if configured.

Each bit is associated with a single analog input:

- bit 4: error state for probe connected to analog input AI1
- bit 5: error state for probe connected to analog input AI2
- bit 6: error state for probe connected to analog input AI3
- bit 7: error state for probe connected to analog input AI4

A probe error state is signalled and, if necessary, managed, only when the respective probe is in use.

Be aware that the measurements are valid only in operation modes in which the valve is enabled (FSM status ≥ 30); in other states, the analog inputs might not be configured correctly.

When the state machine enters the Stand-by off, after the parameters check, it is possible to determine which probes will be used: for example, if an analog positioner is set using setting Pcty = 1, only an error on probe 1 will generate an alarm. If, on the other hand, an algorithm (Pcty ≥ 6) is selected, both the selected primary probes (and, eventually, those chosen as secondary probes) will be able to set an alarm. The signalling of the alarms is thus active after the first entry into the Stand-by off.

In states where it is really necessary that the values from analog inputs are reliable, i.e. in analog positioner and SH-algorithm mode, a more complete probe error management system is activated.

When the analog positioner function is selected (Analog positioner (30)), a probe error on a probe currently in use will trigger a positioning move to the value Probe alarm position (Pr05), and the system is changed to Probe alarm (3), where it will then wait for the clearing of the alarm from the relevant probe.

If a SH-algorithm is active, the probe errors monitored are those related to pressure and temperature measures. Any probe error will be handled as follows:

if the alarm relates to the primary probe (temperature or pressure), and another analog input has been configured as a backup probe (for temperature or pressure respectively), the measurement is automatically read from the backup probe; the corresponding Alarm status (AlSt) bit is set to signal a malfunction on the primary probe. Once the primary probe's alarm state has been cleared, the readings are taken from the primary probe once more.

if no backup probe is defined, or if also the backup probe goes in alarm, the algorithm is disabled; the valve is positioned at Probe alarm position (Pr05), and the FSM enters the Probe alarm (3), where it awaits the clearing of the alarm state.

In each case, positioner or SH-algorithm, when the probe alarm is cleared, the state is automatically changed to Stand-by off.

If the valve is disabled while is in Probe alarm (3), there is a positioning to Stand-by position (Pr20) and then it enters Stand-by off.

9.6 Power failure and backup battery error

The EVDRIVE03 supports connection to a backup battery in order to allow a complete closure of the valve in the case of power supply failure.

There are two alarms: one for the power supply failure (bit 8), the other for a malfunction of the backup battery (bit 9). Clearly, both these alarms make sense only if a backup battery is present (parameter Backup battery (Pb01) = 1).

The backup battery alarm also requires the configuration of DI2 (DI2 logic (PH20) and DI2 function (PH21)).

Note that the backup battery alarm only signalize the malfunction of the battery.

However, if the power fail alarm occurs, in addition to reporting, a valve safety shutdown procedure is started.

Once the alarm is cleared, the system is reset.

An alternative to the backup battery, a solenoid valve connected to the relay may be used to block the flow of the refrigerant.

9.7 Algorithm status

Bit 10 of Alarm status (AlSt) is raised for LOP, MOP, LoSH, HiSH, LowPressure or if the measures needed by the algorithm are not valid.

This monitoring is in effect only while the system is working in SH-algorithm and in manual mode.

The Algorithm status (AlgS) variable holds the specific state that generated the alarm, according to this table:

Algorithm status	Description	
	Value 0	Value 1
bit 0	Measures acquired	Data not read (Alarm status.b10 0□1)
bit 1	algorithm is running	control algorithm halted
bit 2	algorithm is active	algorithm is skipped (manual mode is active)
bit 3	No LoSH algorithm is running	LoSH algorithm is running
bit 4	No LoSH alarm	LoSH alarm (Alarm status.b10 0 > 1)
bit 5	No HiSH algorithm is running	HiSH algorithm is running
bit 6	No HiSH alarm	HiSH alarm (Alarm status.b10 0 > 1)
bit 7	No LOP algorithm is running	LOP algorithm is running
bit 8	No LOP alarm	LOP alarm (Alarm status.b10 0 > 1)
bit 9	No MOP algorithm is running	MOP algorithm is running
bit 10	No MOP alarm	MOP alarm (Alarm status.b10 0 > 1)
bit 11	No LowPressure	LowPressure (warning signal only)
bit 12	No LowPressure alarm	LowPressure alarm (Alarm status.b10 0 > 1)

Note that if the manual mode is active, a read error of the measurement data due to incorrect probe configuration only generates a warning. While, if the control algorithm is running, the inability to read the measurements makes it impossible for the algorithm to continue, so this triggers a probe alarm.

Bits 0 and 1 of Algorithm status (AlgS) are always calculated, while the other bits, given their dependencies on the active control algorithm, are only valid while SH-algorithm is running.

9.8 Algorithm protection functions

9.8.1 LoSH

When enabled (Pa10), this alarm is triggered when the SH drops below the low heating threshold (Pc02, Pp02, Pd02). The condition is signalled in the Algorithm status (AlgS) and, when the timeout (Pa12) expires, an alarm is set.

When the SH returns within its set limits (hysteresis is defined in Pa11), the alarm and its signal are cleared and the normal regulation algorithm resumes.

9.8.2 HiSH

When enabled (PA20), this alarm is triggered when the SH rises above the high heating threshold (Pc03, Pp03, Pd03), a bit is set in Algorithm status (AlgS) and, after the timeout (Pa22) expires, an alarm is set. The alarm and signal are cleared automatically when the SH returns below the threshold (hysteresis defined in Pa21).

9.8.3 LOP

When enabled (Pa40), this alarm is triggered when the evaporation temperature (Te) drop below the LOP threshold (Pc04, Pp04, Pd04). The condition is signalled in the Algorithm status (AlgS) and, when the timeout (Pa42) expires, an alarm is set. This protection is most useful during start-up of the machine, when the evaporation temperature is effectively low. It is possible to optimise this phase by setting a correct value in the valve opening on start-up parameter (parameter Pc21 or Pp21). When the Te temperature returns within its limits (Pa41 defines the hysteresis), the alarm and signalling are cleared and the normal regulation algorithm resumes.

9.8.4 MOP

When enabled (Pa50), this alarm is triggered when the evaporation temperature (Te) rise above the MOP threshold (Pc05, Pp05, Pd05) and activates a specific algorithm for managing the MOP. The condition is signalled in the Algorithm status (AlgS) and, when the timeout (Pa52) expires, an alarm is set. When the Te temperature returns within its limits (Pa51 defines the hysteresis), the alarm and its signal are cleared and the normal regulation algorithm resumes.

9.8.5 LowPressure

When enabled (Pa30), and the evaporation pressure (Pe) falls below the low pressure threshold (Pa31), an warning is signalled. After the timeout (Pa33) expires, the LP alarm is set. The alarm and its signal are cleared automatically when the pressure returns above the threshold. (Pa32 defines the hysteresis).

9.9 Parameters error

Bit 12 of Alarm status (AlSt) indicates that there was a problem during the automatic conversion of the parameters of temperature and/or pressure and it is possible that not all parameters have been successfully converted.

The automatic conversion of the parameters is performed only at the reset after a change in parameters Ph60 and/or Ph61.

If this alarm occurs, the user should check and correct all the parameters of temperature and pressure, cancel the alarm leading to 1 bit 0 of the variable Command (Cmd), and then reset the EVDRIVE03.

10 ACCESSORIES

10.1 Programming key EVKEY10

10.1.1 Introduction

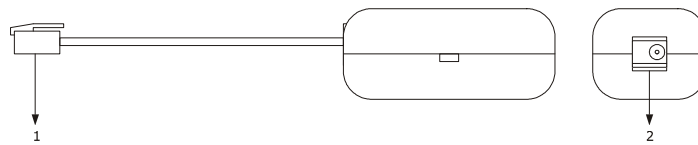
EVKEY10 is a programming key.

Through the key it is possible to make the upload and the download of the application software parameters and / or of the configuration ones.

The key can be used on condition that the devices are powered.

10.1.2 Description

The following drawing shows the aspect of the programming key EVKEY10.

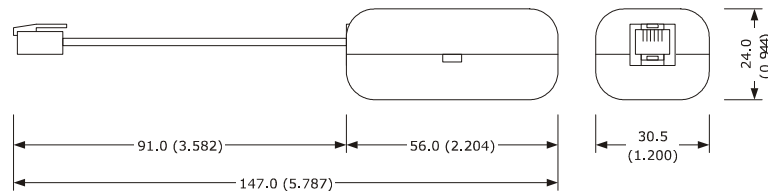


The following table shows the meaning of the parts of the key.

Part	Meaning
1	telephone connector
2	reserved

10.1.3 Size

Size is in mm (in).



10.1.4 Connection to the device

Operate as follows:

1. Plug in the telephone connector of the key into the programming port of the device.

To copy the parameters from the device to the key and vice-versa look at chapter 7 "CONFIGURATION".

10.2 Programming kit EVIF20TUXI

10.2.1 Introduction

EVIF20TUXI is a programming kit.

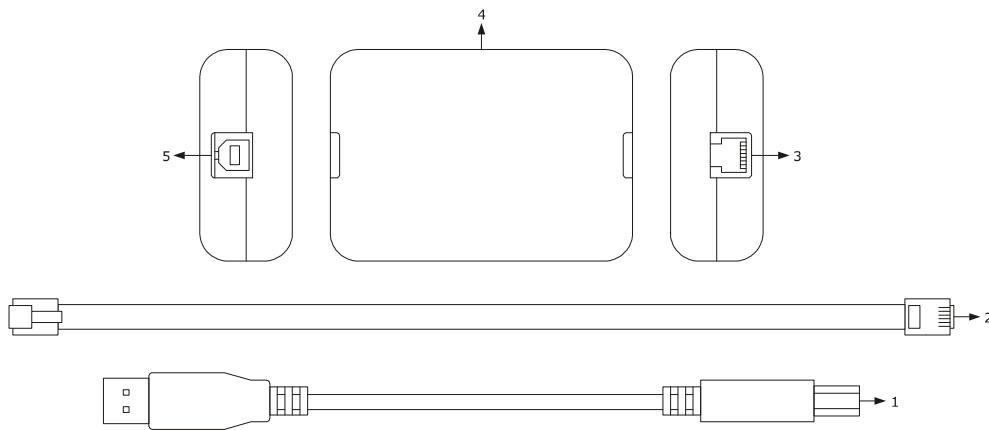
Through the kit it is possible to connect the driver to the set-up software system Parameters Manager (using the programming port).

The kit is made of:

- TTL / USB non optoisolated serial interface
- USB cable (to connect the serial interface to the Personal Computer)
- TTL cable (to connect the serial interface to the driver).

10.2.2 Description

The following drawing shows the aspect of the programming kit EVIF20TUXI.

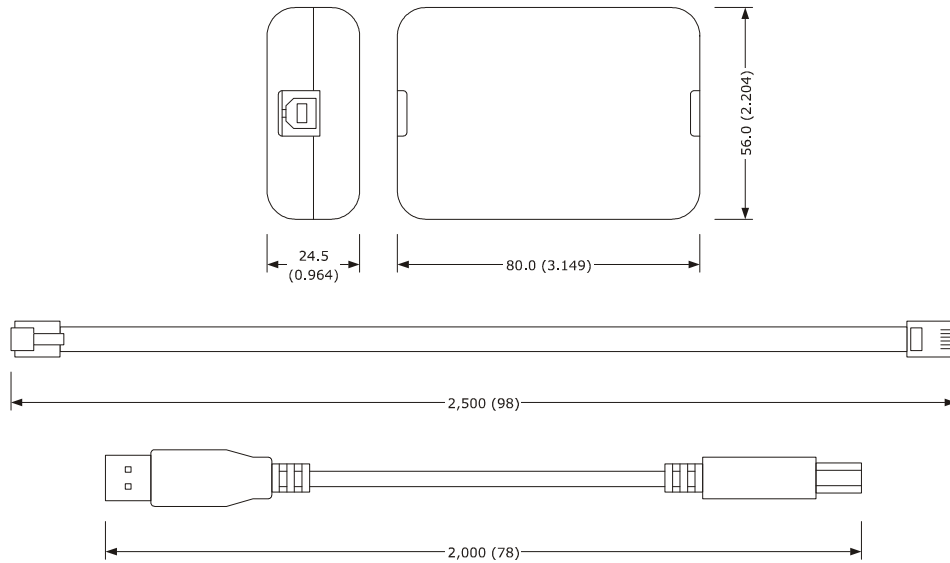


The following table shows the meaning of the parts of the kit.

Part	Meaning
1	USB cable 2 m (6 ft) long
2	TTL cable 2.5 m (8 ft) long
3	TTL port
4	TTL / USB non optoisolated serial interface
5	USB port

10.2.3 Size

Size is in mm (in).



10.2.4 Connection to the Personal Computer

Operate as follows:

1. Plug in an end of the TTL cable into the TTL port of the serial interface.
2. Plug in the other end of the TTL cable into the programming port of the device.
3. Plug in an end of the USB cable into the USB port of the serial interface.
4. Plug in the other end of the USB cable into an USB port of the Personal Computer.

For further information consult the User manual of Parameters Manager.

10.3 Non optoisolated RS-485/USB serial interface EVIF20SUXI

10.3.1 Introduction

EVIF20SUXI is a non optoisolated RS-485/USB serial interface.

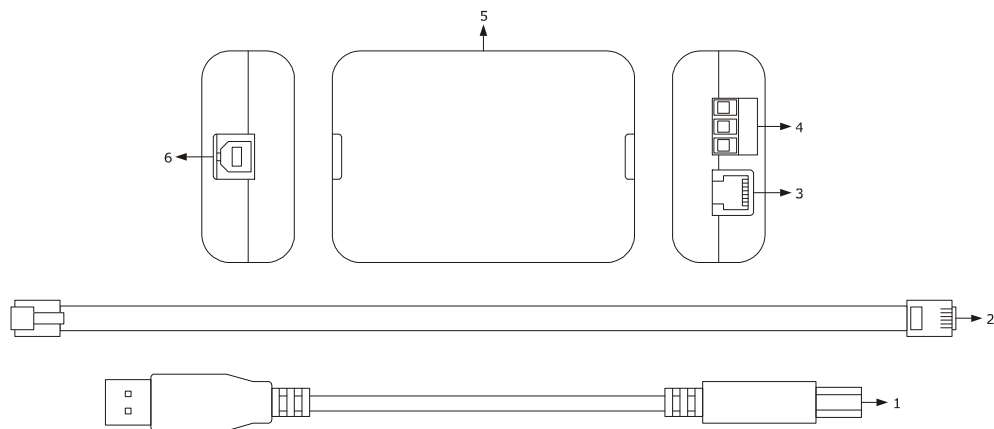
Through the interface it is possible to connect the driver to the set-up software system Parameters Manager and connect a device RS-485 network to the plants monitoring and supervision system RICS (using the RS-485 port).

The interface is made of:

- RS-485 / USB non optoisolated serial interface
- USB cable (to connect the serial interface to the Personal Computer)
- RS-485 cable (this cable is not necessary because the connection serial interface-driver uses a three wires connection).

10.3.2 Description

The following drawing shows the aspect of the interface EVIF20SUXI.

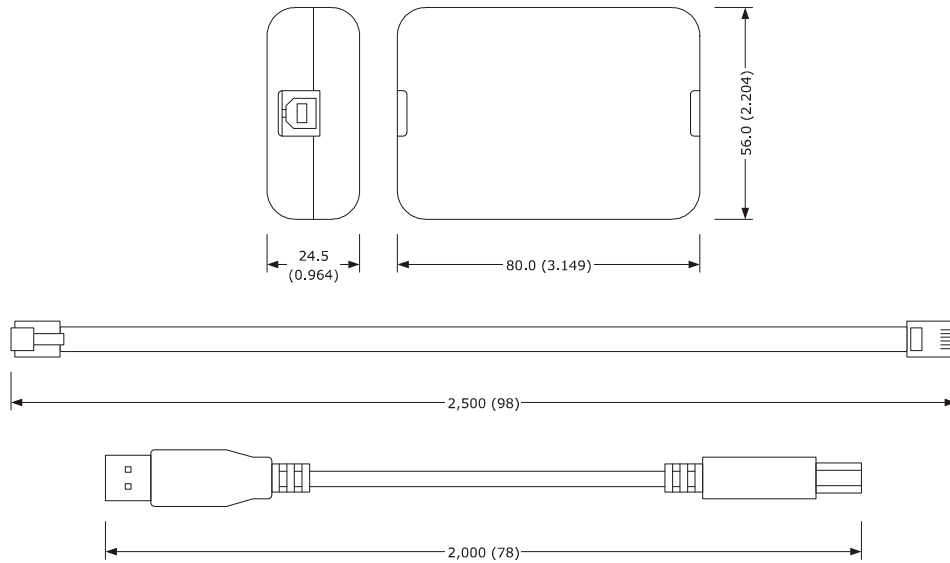


The following table shows the meaning of the parts of the kit.

Part	Meaning
1	USB cable 2 m (6 ft) long
2	RS-485 cable 2.5 m (8 ft) long
3	RS-485 port on telephone connector
4	RS-485 port on screw terminal block
5	RS-485 / USB non optoisolated serial interface
6	USB port

10.3.3 Size

Size is in mm (in).



10.3.4 Connection to the Personal Computer

Operate as follows:

1. Connect the RS-485 port on screw terminal block of the interface to the RS-485 port of the device using three wires and operating as follows:
 - terminal 1 of the interface must be connected to terminal RS485+ of the device
 - terminal 2 of the interface must be connected to terminal RS485- of the device
 - terminal 3 of the interface must be connected to terminal GND of the device.
2. Plug in and end of the USB cable into the USB port of the serial interface.
3. Plug in the other end of the USB cable into an USB port of the Personal Computer.

For further information consult the User manual of Parameters Manager.

10.4 Backup module EPD7BSC

10.4.1 Introduction

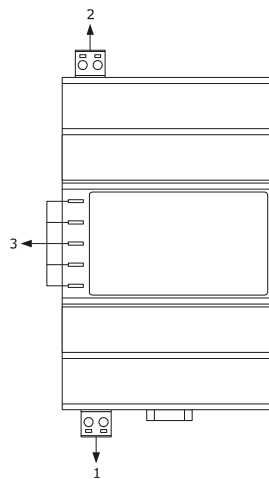
EPD7BSC is a backup module.

Through the module it is possible to close the valve in case of lack of power supply of the driver.

For further information consult the data sheet of EPD7BSC.

10.4.2 Description

The following drawing shows the aspect of the module EPD7BSC.

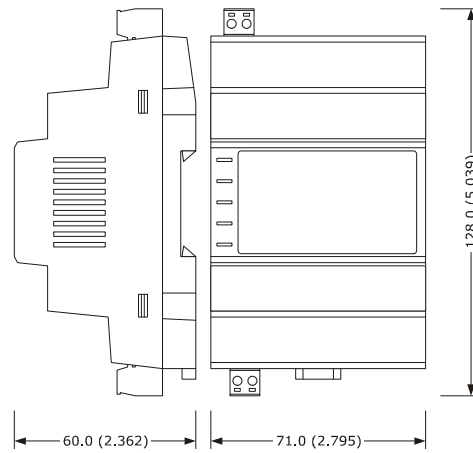


The following table shows the meaning of the parts of the module.

Part	Meaning
1	backup power supply output
2	power supply
3	signal LEDs

10.4.3 Size

Size is in mm (in).



10.4.4 Connection to the device

Look at chapter 4 "ELECTRICAL CONNECTION" Operate as follows:

Please note the power supply of EVDRIVE03 and that of EPD7BSC are not isolated: it is important to wire correctly the devices as indicated in chapter 4.

11 TECHNICAL DATA

11.1 Technical data

Purpose of the device:	electronic expansion valves driver.			
Box:	self-extinguishing grey.			
Size:	71.0 x 128.0 x 60.0 mm (2.795 x 5.039 x 2.362 in; W x H x D); 4 DIN modules.			
	Size refers to the device with the extractable screw terminal blocks properly plugged.			
Installation:	on DIN rail 35.0 x 7.5 mm (1.377 x 0.295 in) or 35.0 x 15.0 mm (1.377 x 0.590 in).			
Index of protection:	IP20; IP40 the front.			
Connections:	EPD4BX3	EPD4BC3	EPD4BF3	EPD4DF3
	male extractable screw terminal blocks with pitch 5.0 mm (0.196 in; power supply and outputs; with pitch 3.5 mm for analog inputs and free of voltage digital inputs) for conductors up to 2.5 mm ² (0.0038 in ²), 6 poles female RJ11 telephone connector (setting and programming port).	male extractable screw terminal blocks with pitch 5.0 mm (0.196 in; power supply, high voltage digital inputs, outputs, CAN port; with pitch 3.5 mm for analog inputs and free of voltage digital inputs) for conductors up to 2.5 mm ² (0.0038 in ²), 6 poles female RJ11 telephone connector (setting and programming port).	male extractable screw terminal blocks with pitch 5.0 mm (0.196 in; power supply, high voltage digital inputs, outputs, CAN port and RS-485 port; with pitch 3.5 mm for analog inputs and free of voltage digital inputs) for conductors up to 2.5 mm ² (0.0038 in ²), 6 poles female RJ11 telephone connector (setting and programming port).	

	<p>The maximum lengths of the connecting cables are the following:</p> <ul style="list-style-type: none"> - power supply device: 30 m (98 ft) - analog inputs: 100 m (328 ft) - power supply 0-20 mA/4-20 mA/0-5 V ratiometric/0-10 V transducers: 100 m (328 ft) - free of voltage digital inputs: 100 m (328 ft) - high voltage digital input: 100 m (328 ft) - digital output: 100 m (328 ft) - bipolar stepper motor output: 5 m (16 ft; 10 m (32 ft) with shielded cable) - CAN port: <ul style="list-style-type: none"> - 1,000 m (3,280 ft) with baud rate 20,000 baud - 500 m (1,640 ft) with baud rate 50,000 baud - 250 m (820 ft) with baud rate 125,000 baud - 50 m (164 ft) with baud rate 500,000 baud - power supply remote user interface: 30 m (98 ft) - RS-485 port: 1,000 m (3,280 ft); also look at the <i>MODBUS specifications and implementation guides</i> manual. <p>One suggests using the connecting kit CJAV17 (female extractable screw terminal blocks pitch 5.0 mm (0.196 in), to order separately).</p>
<p>Operating temperature:</p>	<p>from -10 to 60 °C (from 14 to 140 °F).</p>
<p>Storage temperature:</p>	<p>from -20 to 70 °C (from -4 to 158 °F).</p>
<p>Operating humidity:</p>	<p>from 10 to 90% of relative humidity not condensing.</p>
<p>Pollution situation:</p>	<p>2.</p>
<p>Power supply:</p>	<p>24 VAC +10% -15%, 50/60 Hz ±3 Hz, 40 VA max. not isolated or 24... 37 VDC, 22 W max. not isolated, supplied by a class 2 circuit. If the device is powered in direct current, it is necessary to respect the polarity of the power supply voltage. Protect the power supply with a fuse rated 2 A-T 250 V.</p>
<p>Overvoltage category:</p>	<p>III.</p>

Analog inputs:

4 inputs of which 2 inputs (non optoisolated, which can be set via configuration parameter for NTC/Pt 1000 probes and for 0-20 mA/4-20 mA/0-5 V ratiometric transducers) which can be set via configuration parameter for suction temperature backup probe/suction pressure backup probe, 1 input (non optoisolated, which can be set via configuration parameter for NTC/Pt 1000 probes) as suction temperature probe and 1 input (non optoisolated, which can be set via configuration parameter for 0-20 mA/4-20 mA/0-5 V ratiometric/0-10 V transducers) as suction pressure probe.

NTC analog inputs (10K Ω @ 25 °C, 77 °F)

Kind of sensor:	β 3435.
Working range:	from -40 to 110 °C (from -40 to 230 °F) for standard NTC probes from -50 to 150 °C (from -58 to 302 °F) for high temperature NTC probes from -50 to 110 °C (from -58 to 230 °F) for fast NTC probes.
Accuracy:	\pm 0.6% of the full scale for standard and fast NTC probes \pm 0.5% of the full scale for high temperature NTC probes.
Resolution:	0.1 °C (1 °F).
Conversion time:	100 ms.
Protection:	none.

Pt 1000 analog inputs (1K Ω @ 0 °C, 32 °F)

Working range:	from -100 to 400 °C (from -148 to 752 °F).
Accuracy:	\pm 0.5% of the full scale.
Resolution:	0.5 °C (1 °F).
Conversion time:	100 ms.
Protection:	none.

0-20 mA/4-20 mA analog inputs

Input resistance:	\leq to 200 Ω .
Accuracy:	\pm 1% of the full scale.
Resolution:	0.01 mA.
Conversion time:	100 ms.
Protection:	none; the maximum current allowed on each input is 25 mA.

	<p><u>0-5 V ratiometric analog inputs</u></p> <p>Input resistance: \geq to 10K Ω. Accuracy: $\pm 1\%$ of the full scale. Resolution: 0.01 V. Conversion time: 100 ms. Protection: against the reversal of polarity.</p> <hr/> <p><u>0-10 V analog inputs</u></p> <p>Input resistance: \geq to 10K Ω. Accuracy: $\pm 1\%$ of the full scale. Resolution: 0.01 V. Conversion time: 100 ms. Protection: against the reversal of polarity.</p> <hr/> <p>Power supply 0-20 mA/4-20 mA/0-10 V transducers: 12 VDC $\pm 10\%$, 60 mA max. Power supply 0-5 V ratiometric transducers: 5 VDC $\pm 5\%$, 40 mA max. The device incorporate a restorable thermal protection of the power supplies against the short circuit and the overload.</p>			
<p>Digital inputs:</p>	<p>3 inputs of which 2 inputs (non optoisolated free of voltage contacts, which can be set via configuration parameter as normally open/normally closed contact) which can be set via configuration parameter as enable the operation/change parameters set/resynchronization command/backup module status and 1 input (optoisolated high voltage contact, which can be set via configuration parameter as normally open/normally closed contact) which can be set via configuration parameter as enable the operation/change parameters set/resynchronization command/backup module status (not available in model EPD4BX3).</p> <hr/> <p><u>Non optoisolated free of voltage contacts</u></p> <p>Power supply: none (5 V when not loaded, 3.3 mA when loaded). Protection: none.</p> <hr/> <p><u>Optoisolated high voltage contact</u></p> <p>Power supply: 115 VAC -10%... 230 VAC +10%. Protection: none. The device ensure a reinforced isolation among each terminal of the high voltage contact and the remaining parts of the device.</p>			
<p>Displays:</p>	<p>EPD4BX3</p>	<p>EPD4BC3</p>	<p>EPD4BF3</p>	<p>EPD4DF3</p>

	<p>signalling LEDs.</p>				<p>128 x 64 pixel single colour (black with rearlighting through white LEDs) LCD graphic display, signalling LEDs.</p>
<p>Digital outputs:</p>	<p>1 SPST 5 res. A @ 250 VAC (5 res. A @ 30 VDC) output (electromechanical relay) which can be set via configuration parameter as alarm output/solenoid valve/resynchronization valve.</p> <hr/> <p><u>Electromechanical relay</u></p> <p>Maximum switching power: 1,250 VA (150 W). Mechanical life: > to 5,000,000 operations. Electrical life: > to 100,000 operations. Protection: none.</p> <p>The device ensure a reinforced isolation among each terminal of the digital output and the remaining parts of the device.</p>				
<p>Bipolar stepper motor output:</p>	<p>4 wires bipolar stepper motor output.</p> <hr/> <p><u>Bipolar stepper motor output</u></p> <p>Input voltage: 21 VDC ±10%. Output voltage: 27... 36 VDC (18... 24 VDC if supplied by the backup module). Maximum output current: 1 A. Driver type: chopper (constant current). Protection: none.</p>				
<p>Type of actions and additional features:</p>	<p>1C.</p>				
<p>Communication ports:</p>	<p>EPD4BX3</p>	<p>EPD4BC3</p>	<p>EPD4BF3</p>	<p>EPD4DF3</p>	

	<p>1 non optoisolated programming port with MODBUS communication protocol.</p>	<p>2 non optoisolated ports of which 1 CAN port with CANBUS communication protocol and 1 programming port with MODBUS communication protocol.</p>	<p>3 non optoisolated ports of which 1 CAN port with CANBUS communication protocol, 1 RS-485 port with MODBUS communication protocol and 1 programming port with MODBUS communication protocol.</p>
	<p>Power supply remote user interface: 22... 35 VDC, 100 mA max.</p>		

EVDRIVE03

Electronic expansion valves drivers

User manual ver. 3.1

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