EVCO
Advanced Controllers

EVDRIVE05

Driver for unipolar stepper and pulse motorised electronic expansion valves

⚠ WARNING

Make sure you read and fully understand the manual before using this device.

Non-observance of these instructions may result in death or serious injury.

Operating manual

114EV05E4.00 - 02/2025

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IMPORTANT LEGAL INFORMATION

LIABILITY AND RESIDUAL RISKS

EVCO assumes no liability for any damage caused by the following (by way of example; this is not an exhaustive list):

- Installation/use for purposes other than those specified and, in particular, not adhering to the safety provisions set out by current regulations in the country in which the product is installed and/or contained in this manual;
- Use in appliances that do not guarantee sufficient protection against electric shocks, water and dust within the installation conditions created;
- Use in appliances that allow access to hazardous parts without the use of a keyed or tooled locking mechanism when accessing the instrument;
- Tampering and/or modifying the product;
- Installation/use in appliances which do not comply with current regulations in the country in which the product is installed.

The customer/manufacturer is responsible for ensuring their machine complies with these regulations.
EVCO's responsibility is limited to the correct and professional use of the product in accordance with regulations and the instructions contained in this manual and other product support documents.

To comply with EMC standards, observe all the electrical connection instructions. As it depends on the wiring configuration as well as the load and the installation type, compliance must be verified for the final machine as specified by the relevant product standard.

DISCLAIMER

This document is the exclusive property of EVCO. It contains a general description and/or a description of the technical specifications for the services offered by the products listed herein. This document should not be used to determine the suitability or reliability of these products in relation to specific user applications. Each user or integration specialist should conduct their own complete and appropriate risk analysis, in addition to carrying out a product evaluation and test in relation to its specific application or use. Users can send us comments and suggestions on how to improve or correct this publication.

Neither EVCO nor any of its associates or subsidiaries shall be held responsible or liable for improper use of the information contained herein.

EVCO has a policy of continuous development; therefore, EVCO reserves the right to make changes and improvements to any product described in this document without prior notice.

The images in this document and other documentation supplied with the product are provided for illustrative purposes only and may differ from the product itself.

The technical data in this manual is subject to change without prior notice.

TERMS AND CONDITIONS OF USE

Permitted use

The device must be installed and used in accordance with the instructions provided and, in particular, hazardous live parts must not be accessible under normal conditions.

The device must be suitably protected from water and dust with regard to its application and must also only be accessible with the aid of a tool (with the exception of the front panel).
Only qualified personnel may install the product or perform technical support procedures on it.

The customer must only use the product as described in the documentation relating to that product.

Prohibited use

Any use other than those described in the "**Permitted use**" section and in the product support documentation is prohibited.

DISPOSAL

The device must be disposed of in accordance with local regulations regarding the collection of electrical and electronic appliances.

CONSIDER THE ENVIRONMENT

The company works towards protecting the environment, while taking account of customer requirements, technological innovations in materials, and the expectations of the community to which we belong. EVCO places great importance on respecting the environment, encouraging all associates to become involved with company values and guaranteeing safe, healthy and functional working conditions and workplaces.
Please consider the environment before printing this document.

IMPORTANT SAFETY INFORMATION

Please read this document carefully before installation; study all the warnings before using the device. Only use the device in accordance with the methods described in this document. The following safety messages may be repeated several times in the document, to provide information regarding potential hazards or to attract attention to information which may be useful in explaining or clarifying a procedure.

SYMBOLS USED IN THIS MANUAL

This symbol is used to indicate a risk of electric shock.
It is a safety indication and as such, should be observed to avoid potential accidents or fatalities.

This symbol is used to indicate a risk of serious personal injury.
It is a safety indication and as such, should be observed to avoid potential accidents or fatalities.

SAFETY MESSAGES

DANGER

DANGER indicates a situation of imminent danger which, if not avoided, **will lead to death or serious injury**.

WARNING

WARNING indicates a situation of imminent danger which, if not avoided, **may lead to death or serious injury**.

CAUTION

CAUTION indicates a potentially hazardous situation which, if not avoided, **could cause minor or moderate injury.**

NOTICE

NOTICE indicates a situation not related to physical injuries but which, if not avoided, could damage the equipment.

NOTE: the maintenance, repair, installation and use of the equipment must only be entrusted to qualified personnel.

QUALIFIED PERSONNEL

Only suitably trained and experienced personnel capable of understanding the content of this manual and all documentation regarding the product are authorised to work on and with this equipment. Furthermore, the personnel must have completed courses in safety and must be able to recognise and prevent the implied dangers. The personnel must have suitable training, knowledge and experience at a technical level, and be capable of anticipating and detecting potential risks caused by using the product, as well as changing the settings and modifying the mechanical, electric and electronic equipment for the entire system in which the product is used. All personnel working on and with the product must be entirely familiar with the relevant standards and directives, as well as safety regulations.

UNAUTHORISED PERSONNEL

The device must **not** be used by persons (including children) with reduced physical, sensory or mental capabilities or persons with no experience or knowledge.

SAFETY PRECAUTIONS CONCERNING THE PRODUCT AND ITS USE

Before carrying out any work on the equipment, read these instructions carefully, making sure you understand everything.

⚠ DANGER

RISK OF ELECTRIC SHOCK, EXPLOSION OR ELECTRIC ARC

- Only use electrically insulated measuring devices and equipment.
- Do not install the equipment while the power supply is connected.
- Cut off the power supply to all equipment, including any connected devices, before installing/uninstalling the device.
- Always use a properly calibrated Voltmeter to make sure the system is powered off.
- Do not touch the unshielded components or the terminals while they are live.
- Do not open, disassemble, repair or modify the product.
- Do not expose the equipment to liquids or chemicals.
- All 12 Vac models must be powered individually.
- Before applying voltage to the equipment:
  - Make sure all protective elements, such as covers, hatches and grilles, are fitted and/or closed.
  - Check all wiring connections.

⚠ DANGER

RISK OF ELECTRIC SHOCK AND FIRE

- Do not use the device with loads greater than those indicated in the technical data section.
- Do not exceed the temperature and humidity ranges indicated in the technical data section.
- Use the required safety interlocks (fuses and/or magnetothermal switches) of a suitable size.

⚠ DANGER

RISK OF ELECTRIC SHOCK OR MALFUNCTIONING OF THE EQUIPMENT

Do not use damaged products or accessories.

⚠ WARNING

MALFUNCTIONING OF THE EQUIPMENT

- Perform the wiring carefully, in compliance with electromagnetic compatibility requirements.
- Make sure the wiring is correct for its application.
- Use shielded cables for all I/O signal and communication cables.
- Minimise the length of the connections as much as possible, to avoid winding the cables around electrically connected parts.
- The signal (digital and analogue inputs, communication and corresponding power supplies) and power cables for the device must be routed separately.
- Before applying the power supply, check all the wiring connections.
- Use the necessary safety interlocks wherever the risk of injury to personnel and/or equipment damage exists.
- Install and use this device in a cabinet of a suitable class for the intended environment, protected by a keyed locking mechanism or other suitable instruments.
- In terms of connection and the fuses used in the circuits for the power supply and output lines, observe local and national regulatory requirements relating to the nominal current and voltage for the equipment in use.
- Do not use this equipment for machine functions that are critical to safety.
- Do not disassemble, repair or modify the equipment.
- Do not connect wires to unused terminals and/or terminals marked with the text “No connection” (“N.C.”).

This device was designed to operate in non-hazardous environments, excluding applications that generate, or could potentially generate, hazardous atmospheres. Only install this device in areas and for applications which are reliably free from hazardous atmospheres.

⚠ DANGER

RISK OF EXPLOSION

- Only install and use this device in sites that are not at risk.
- Do not install or use this device in applications which are capable of generating hazardous atmospheres, such as applications that use flammable refrigerants.

INFORMATION CONCERNING THE DOCUMENT

⚠ WARNING

MALFUNCTIONING OF THE EQUIPMENT

Make sure you read and fully understand the manual before using this device.

Non-observance of these instructions may result in death or serious injury.

PURPOSE OF THE DOCUMENT

This document describes the driver for **EVDRIVE05** unipolar stepper and pulse motorised electronic expansion valves. The information provided includes:

- Safety;
- Installation;
- Wiring;
- Commissioning;
- Usage;
- Configuration.

NOTE: read this document - and all related documents - carefully before installing, operating or servicing the controller.

INTENDED READERS

This manual is intended for readers in different countries. Both metric and imperial units of measurement are used in the manual.

APPLICATION AND VALIDITY

This manual refers only to the **EVDRIVE05** driver.

RELATED TECHNICAL DOCUMENTS

Document	Code (p/n)	Language
EVDRIVE05 operating manual, EN	**114EVD05E4**	ENGLISH
EVDRIVE05 series instruction sheet, EN-IT	**104EVD05A3**	MULTILINGUAL (EN-IT)

1. INTRODUCTION

1.1 DESCRIPTION

The **EVDRIVE05** series driver is EVCO's comprehensive solution for managing unipolar stepper and pulse motorised electronic expansion valves to meet the requirements of the HVAC/R market.

Among the numerous functions, it is worth mentioning its ability to operate in both stand-alone mode and under the supervision of a controller, manage generic electronic expansion valves and the most common Sporlan, Danfoss, Sanhua valves, and manage backup probes.

1.2 AVAILABLE MODELS

The **EVDRIVE05** series consists of two models:

- **EVDRIVE05 Pulse**;
  - **EVDRIVE05 Pulse 24 Vac**;
  - **EVDRIVE05 Pulse 230 Vac**;
- **EVDRIVE05 Unipolar**;

1.3 FEATURES

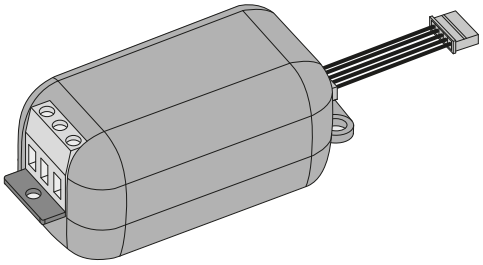
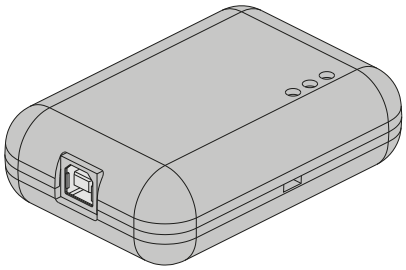
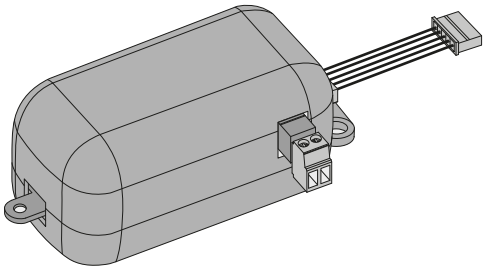
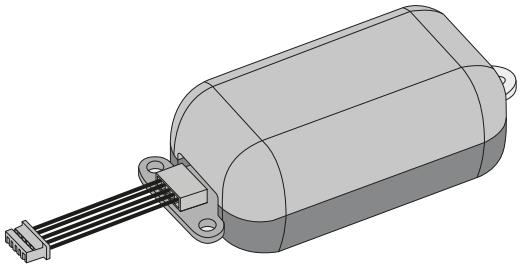
The main features of the **EVDRIVE05** series are:

- 2 multifunctional analogue inputs, of which:
  - 1 analogue input for:
    - 4...20 mA sensors;
    - 0...20 mA sensors;
    - 0...5 V sensors;
    - NTC probes;
    - Pt1000 probes;
  - 1 analogue input for:
    - NTC probes;
    - Pt1000 probes;
- 1 voltage-free digital input;
- 1 non-sealed relay output (sealed version also available on request);
- 1 Intrabus serial port;
  - Compatibility for connection to EVCO parametric and programmable controllers;
- 1 RS-485 serial port;
  - Compatibility for connection to third-party controls;
  - Compatible with BMS interfacing via Modbus protocol;
- 1 TTL port;
  - Compatibility for connection to Wi-Fi EVlining;
  - Compatibility for connection to BLE EVlining;
- Compatible for interfacing with EVconnect App;

NOTE: for further information regarding input/output specifications, please refer to paragraph ***"2.1 TECHNICAL SPECIFICATIONS" ON PAGE 11***.

1.4 ACCESSORIES

The accessories available for the **EVDRIVE05** are:

Type	P/n	Description
	**EVTPN530F202**	NTC FAST temperature probes (intake temperature)
	**EVTPN815S201**	NTC temperature probes up to 150 °C (discharge temperature)
	**EVTPMC15V200**	Pt1000 temperature probes 0...350 °C with fibreglass cable
	**EVIF24TSX**	TTL RS-485 EVlinking TTL/RS-485 serial interface
	**EVIF20SUXI**	EVIF20SUXI RS-485/USB serial interface
	**EVIF25TWX**	TTL Wi-Fi EVlinking TTL / Wi-Fi serial interface
	**EVIF25TBX**	BLE module for connection to EVconnect APP

2. TECHNICAL SPECIFICATIONS

All the system components of **EVDRIVE05** drivers satisfy European Community (EC) requirements for open systems. They must be installed in casing or another location designated on the basis of specific environmental conditions and in order to minimise the risk of involuntary contact with hazardous voltage. Use metal casing to improve **EVDRIVE05** system immunity to electromagnetic fields. This equipment satisfies the EC requirements as indicated in the tables below.

⚠ WARNING

MALFUNCTIONING OF THE EQUIPMENT

Do not exceed any of the nominal values specified in this section.

2.1 TECHNICAL SPECIFICATIONS

2.1.1 EVDRIVE05

Type	Description
The product complies with the following harmonised standards:	EN60730-1 and EN60730-2-9
Device construction:	Incorporated electronic device
Device purpose:	Operational control Driver for expansion valve (not safety)
Type of action:	1.C
Pollution category:	2
Overvoltage category:	III
Nominal pulse voltage:	1000 V
Power supply:	12 Vac, +10 % -15 %, 50/60 Hz not isolated
Consumption:	3.2 VA maximum
Ambient operating conditions:	0... 60 °C (32...140 °F) 10 ... 90 % RH non-condensing
Transportation and storage conditions:	-25...70 °C (-13 ... 158 °F) 10 ... 90 % RH non-condensing
Software class:	A
Protection degree provided by the casing:	IP00

2.2 I/O SPECIFICATIONS

2.2.1 EVDRIVE05 Unipolar

Type	Description
Digital inputs	1 voltage-free digital input (3.3 Vdc, 1 mA)
Analogue inputs	1 analogue input for NTC, Pt1000, 0...5 V, 0...20 mA or 4...20 mA 1 analogue input for NTC or Pt1000
Low voltage (SELV) digital output	1 SPDT digital output 5 A at 250 Vac
Serial port	1 RS-485 serial port 1 Intrabus serial port 1 TTL port
Valve output	1 EEV Unipolar Stepper output

EVDRIVE05 analogue input specifications

	NTC 10 kΩ at 25 °C BETA 3435	Pt1000 1 kΩ at 0 °C	Current 0...20 mA 4...20 mA	Voltage 0...5 V	Digital input
AI M	•	•	•	•	•
AI T	•	•	---	---	•
Range	-50...120 °C (-58...248 °F)	-100...400 °C (-148...752 °F)	-	-	-
Resolution	0.1 °C (1 °F)		0.01 mA	0.01 V	-
Input impedance	10 kΩ	1 kΩ	≤ 200 Ω	≥ 10 kΩ	-

Digital output specifications

Relay output	Description	Load (at 250 Vac)	Load type
Out1	SPST	5 A	Resistive

2.2.2 EVDRIVE05 Pulse

Type	Description
Digital inputs	1 voltage-free digital input (3.3 Vdc, 1 mA)
Analogue inputs	1 analogue input for NTC, Pt1000, 0...5 V, 0...20 mA or 4...20 mA 1 analogue input for NTC or Pt1000
Low voltage (SELV) digital output	1 SPDT digital output 5 A at 250 Vac
Serial port	1 RS-485 serial port 1 Intrabus serial port 1 TTL port
Valve output	**24 Vac model**: 1 output for 24 Vac valves **230 Vac model**: 1 output for 230 Vac valves

EVDRIVE05 analogue input specifications

	NTC 10 kΩ at 25 °C BETA 3435	Pt1000 1 kΩ at 0 °C	Current 0...20 mA 4...20 mA	Voltage 0...5 V	Digital input
AI M	•	•	•	•	•
AI T	•	•	---	---	•
Range	-50...120 °C (-58...248 °F)	-100...400 °C (-148...752 °F)	-	-	-
Resolution	0.1 °C (1 °F)		0.01 mA	0.01 V	-
Input impedance	10 kΩ	1 kΩ	≤ 200 Ω	≥ 10 kΩ	-

Digital output specifications

Relay output	Description	Load (at 250 Vac)	Load type
Out1	SPST	5 A	Resistive

3. MECHANICAL ASSEMBLY

3.1 BEFORE YOU START

Read this manual carefully before installing the system.
In particular, the safety instructions, electrical requirements and current regulations for the machine or the process in which this device is involved must be observed. The use and application of the information contained herein requires experience in the design and programming of automated control systems. Only the user, integrator or manufacturer of the machine can be familiar with all the conditions and factors which arise during installation and configuration, operation and maintenance of the machine or the process, and as such can identify the relevant automation equipment and the corresponding interlocks and safety systems which can be used effectively and appropriately. When selecting automation and control equipment and other connected equipment and software, for a particular application, you must consider all applicable local, regional and national standards and/or regulations.

⚠ WARNING

REGULATORY INCOMPATIBILITY

Make sure all the equipment used and the systems conform to all applicable local, regional and national regulations and standards.

3.2 INFORMATION CONCERNING INSTALLATION AND THE SURROUNDING ENVIRONMENT

Before carrying out any work on the equipment, read these instructions carefully, making sure you understand everything.

⚠ ⚠ DANGER

RISK OF ELECTRIC SHOCK, EXPLOSION OR ELECTRIC ARC

- Only use electrically insulated measuring devices and equipment.
- Do not install the equipment while the power supply is connected.
- Cut off the power supply to all equipment, including any connected devices, before installing/uninstalling the device.
- Always use a properly calibrated Voltmeter to make sure the system is powered off.
- Do not touch the unshielded components or the terminals while they are live.
- Do not open, disassemble, repair or modify the product.
- Do not expose the equipment to liquids or chemicals.
- Before applying voltage to the equipment:
  - Make sure all protective elements, such as covers, hatches and grilles, are fitted and/or closed.
  - Check all wiring connections.

This device was designed to operate in non-hazardous environments, excluding applications that generate, or could potentially generate, hazardous atmospheres. Only install this device in areas and for applications which are reliably free from hazardous atmospheres.

⚠ DANGER

RISK OF EXPLOSION

- Only install and use this device in sites that are not at risk.
- Do not install or use this device in applications which are capable of generating hazardous atmospheres, such as applications that use flammable refrigerants.

⚠ WARNING

MALFUNCTIONING OF THE EQUIPMENT

- Perform the wiring carefully, in compliance with electromagnetic compatibility and safety requirements.
- Make sure the wiring is correct for its application.
- Use shielded cables for all I/O signal and communication cables.
- Minimise the length of the connections as much as possible, to avoid winding the cables around electrically connected parts.
- The signal (digital and analogue inputs, communication and corresponding power supplies) and power cables for the device must be routed separately.
- Before applying the power supply, check all the wiring connections.
- Use the necessary safety interlocks wherever the risk of injury to personnel and/or equipment damage exists.
- Install and use this device in a cabinet of a suitable class for the intended environment, protected by a keyed locking mechanism or other suitable instruments.
- In terms of connection and the fuses used in the circuits for the power supply and output lines, observe local and national regulatory requirements relating to the nominal current and voltage for the equipment in use.
- Do not use this equipment for machine functions that are critical to safety.
- Do not disassemble, repair or modify the equipment.
- Do not connect wires to unused terminals and/or terminals marked with the text “No connection” (“N.C.”).

3.3 DIMENSIONS

3.3.1 EVDRIVE05

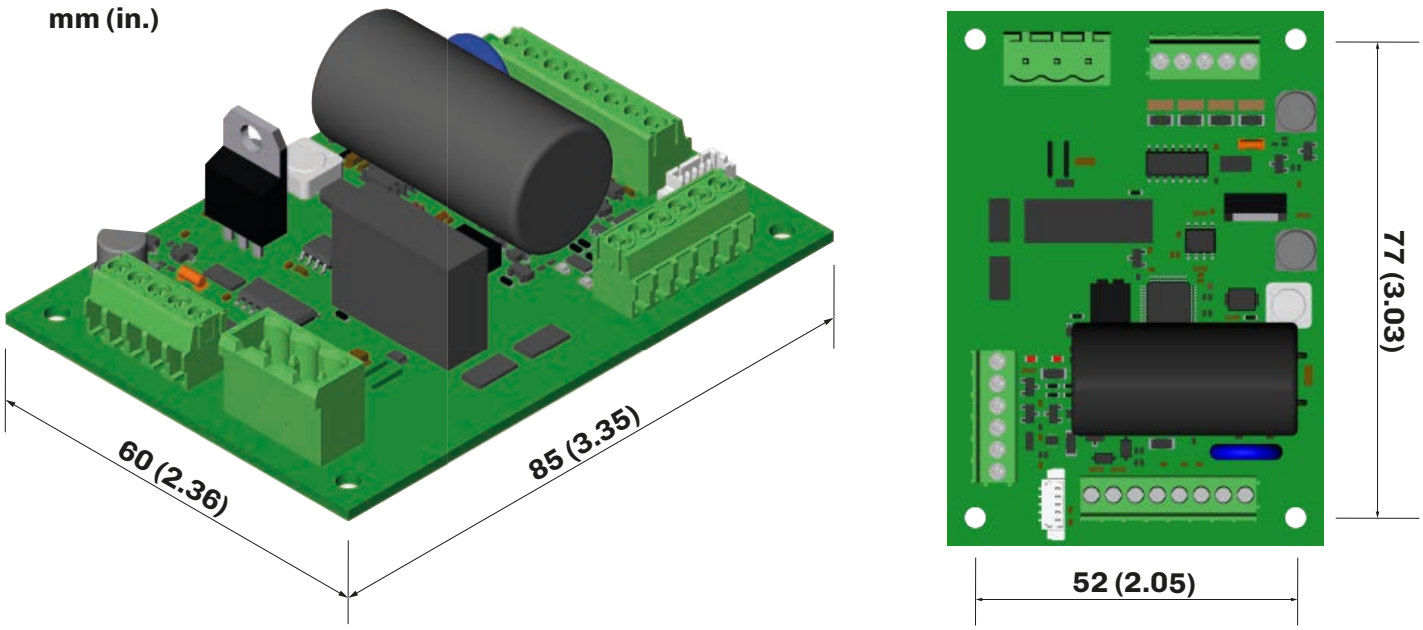


FIG. 1. ***EVDRIVE05*** *dimensions*

3.4 INSTALLATION

Only install the **EVDRIVE05** on plastic spacers (not supplied) in the electrical panel.

4. ELECTRICAL CONNECTIONS

4.1 WIRING BEST PRACTICES

The following information describes the wiring guidelines and best practices which should be observed when using the equipment described in this user manual.

⚠ DANGER

RISK OF ELECTRIC SHOCK, EXPLOSION OR ELECTRIC ARC

- Only use electrically insulated measuring devices and equipment.
- Do not install the equipment while the power supply is connected.
- Cut off the power supply to all equipment, including any connected devices, before installing/uninstalling the device.
- Always use a properly calibrated Voltmeter to make sure the system is powered off.
- Do not touch the unshielded components or the terminals while they are live.
- Do not open, disassemble, repair or modify the product.
- Do not expose the equipment to liquids or chemicals.
- All 12 Vac models must be powered individually.
- Before applying voltage to the equipment:
  - Make sure all protective elements, such as covers, hatches and grilles, are fitted and/or closed.
  - Check all wiring connections.

4.1.1 Wiring guidelines

When wiring the controllers, observe the following standards:

- The I/O and communication wiring must be kept separate from the power supply wiring. These two types of wiring must be routed in separate ducts.
- Make sure the operating environment and conditions fall within the specified values.
- Use wires with the correct diameter, suited to the voltage and current requirements.
- Use copper conductors (compulsory).
- Use shielded twisted pair cables for analogue/digital I/O connections.

Use correctly earthed shielded cables for all inputs or analogue outputs and for communication connections. If shielded cables are not used for these connections, electromagnetic interference may cause signal degradation. Degraded signals can result in unpredictable operation of the controller or the modules and connected equipment.

⚠ WARNING

MALFUNCTIONING OF THE EQUIPMENT

- Perform the wiring carefully, in compliance with electromagnetic compatibility and safety requirements.
- Make sure the wiring is correct for its application.
- Use shielded cables for all I/O signal and communication cables.
- Minimise the length of the connections as much as possible, to avoid winding the cables around electrically connected parts.
- The signal (digital and analogue inputs, communication and corresponding power supplies) and power cables for the device must be routed separately.
- Before applying the power supply, check all the wiring connections.
- Use the necessary safety interlocks wherever the risk of injury to personnel and/or equipment damage exists.
- Install and use this device in a cabinet of a suitable class for the intended environment, protected by a keyed locking mechanism or other suitable instruments.
- In terms of connection and the fuses used in the circuits for the power supply and output lines, observe local and national regulatory requirements relating to the nominal current and voltage for the equipment in use.
- Do not use this equipment for machine functions that are critical to safety.
- Do not disassemble, repair or modify the equipment.
- Do not connect wires to unused terminals and/or terminals marked with the text “No connection” (“N.C.”).

4.1.2 Guidelines for screw terminals

Suitable wiring for the power supply

Step 5.08 mm (0,199 in.)

mm / in. 7 / 0.28								
mm^2	0.2…2.5	0.2…2.5	0.25…2.5	0.25…2.5	2 x 0.2…1	2 x 0.2…1.5	2 x 0.25…1	2 x 0.5...1.5
AWG	*24…14*	*24…14*	*22...14*	*22...14*	*2 x 24…18*	*2 x 24…16*	*2 x 22…18*	*2 x 20...16*

Ø 3.5 mm (*0.14 in.*)	C	N•m	0.5...0.6
		lb-in	*4.42...5.31*

FIG. 2. *Suitable wiring for the power supply*

Suitable wiring for I/O SELV

Step 3.5 mm (0,137 in.)

mm / in. 7 / 0.28								
mm^2	0.14…1.5	0.14…1.5	0.25…1.5	0.25…0.5	2 x 0.08…0.5	2 x 0.08…0.5	2 x 0.25…0.34	2 x 0.5...0.5
AWG	*25…15*	*25…15*	*22...15*	*22...20*	*2 x 28…20*	*2 x 28…20*	*2 x 23…21*	*2 x 20...20*

Ø 3.5 mm (*0.14 in.*)	C	N•m	0.5...0.6
		lb-in	*4.42...5.31*

FIG. 3. *Suitable wiring for I/O SELV*

4.1.3 Permitted cable lengths

NOTICE

INOPERABLE EQUIPMENT

- When connecting the power supply, use cables that are no longer than 10 m (32.80 ft.).
- When connecting the probes, digital inputs and the Intrabus serial line, use cables that are no longer than 10 m (32.80 ft.).
- When connecting the RS-485 serial line, use cables that are no longer than 1000 m (3280 ft).
- When connecting the digital outputs, use cables that are no longer than 10 m (32.80 ft).

4.2 WIRING DIAGRAM

4.2.1 EVDRIVE05 Unipolar

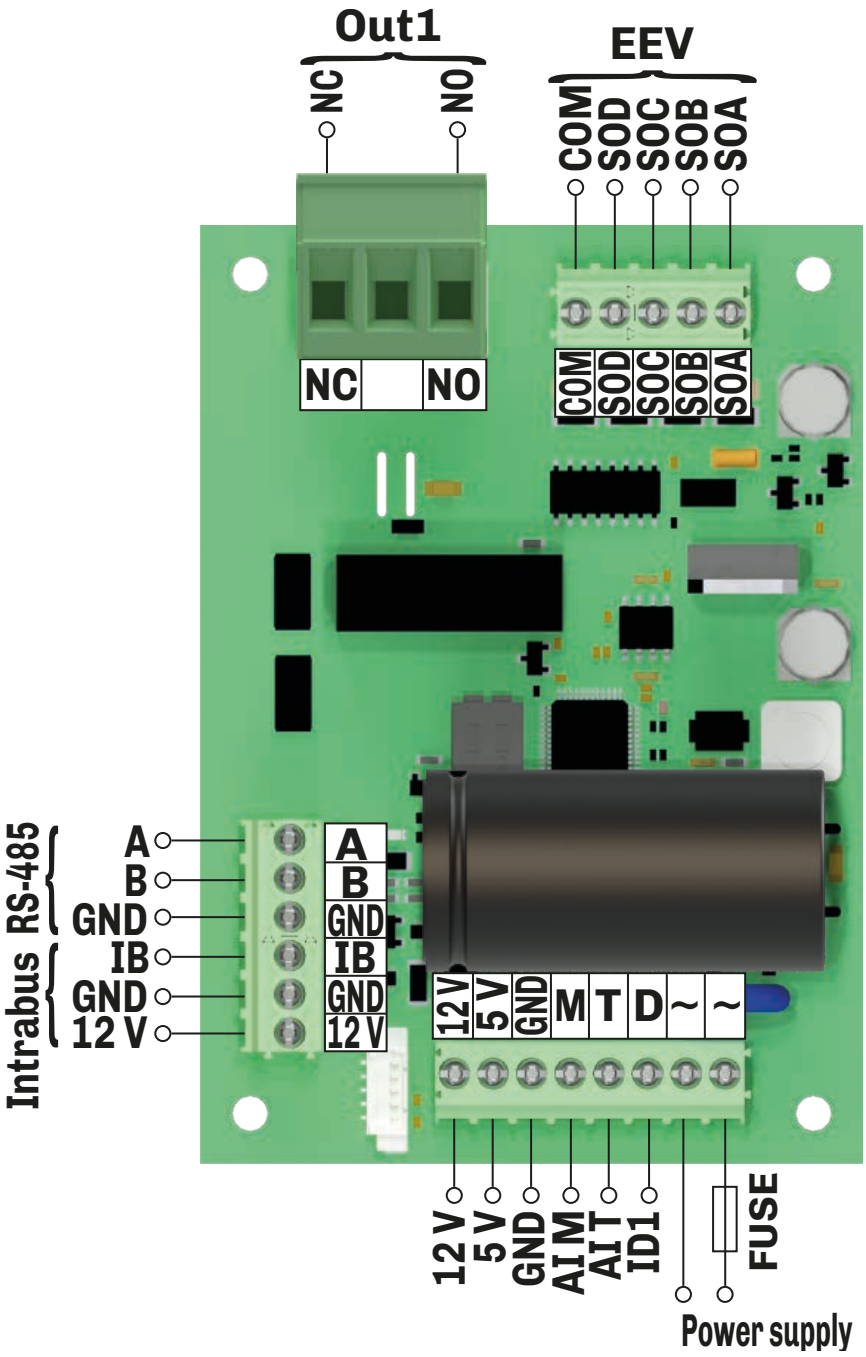


***FIG. 4. EVDRIVE05 Unipolar** connection diagram*

TERMINALS					
COM SOD SOC SOB SOA	Unipolar valve stepper motor output	C	Common	GND AI T	**AI T** analogue input
		2B	Coil 2	GND ID1	**ID1** digital input
		2A	Coil 2	≃	Power Supply Input
		1B	Coil 1	NO NC	Digital output
		1A	Coil 1		
+12V GND	Power supply 0...20 mA/4...20 mA/0...10 V transducers (12 Vdc ±10 %, 60 mA maximum)			IB GND 12 V	Intrabus serial line connection
+5V GND	Power supply 0...5 V ratiometric transducers (5 Vdc ±5 %, 40 mA maximum)			A B GND	RS-485 serial line connection
AI M +12V GND	**AI M** analogue input				

4.2.2 EVDRIVE05 Pulse

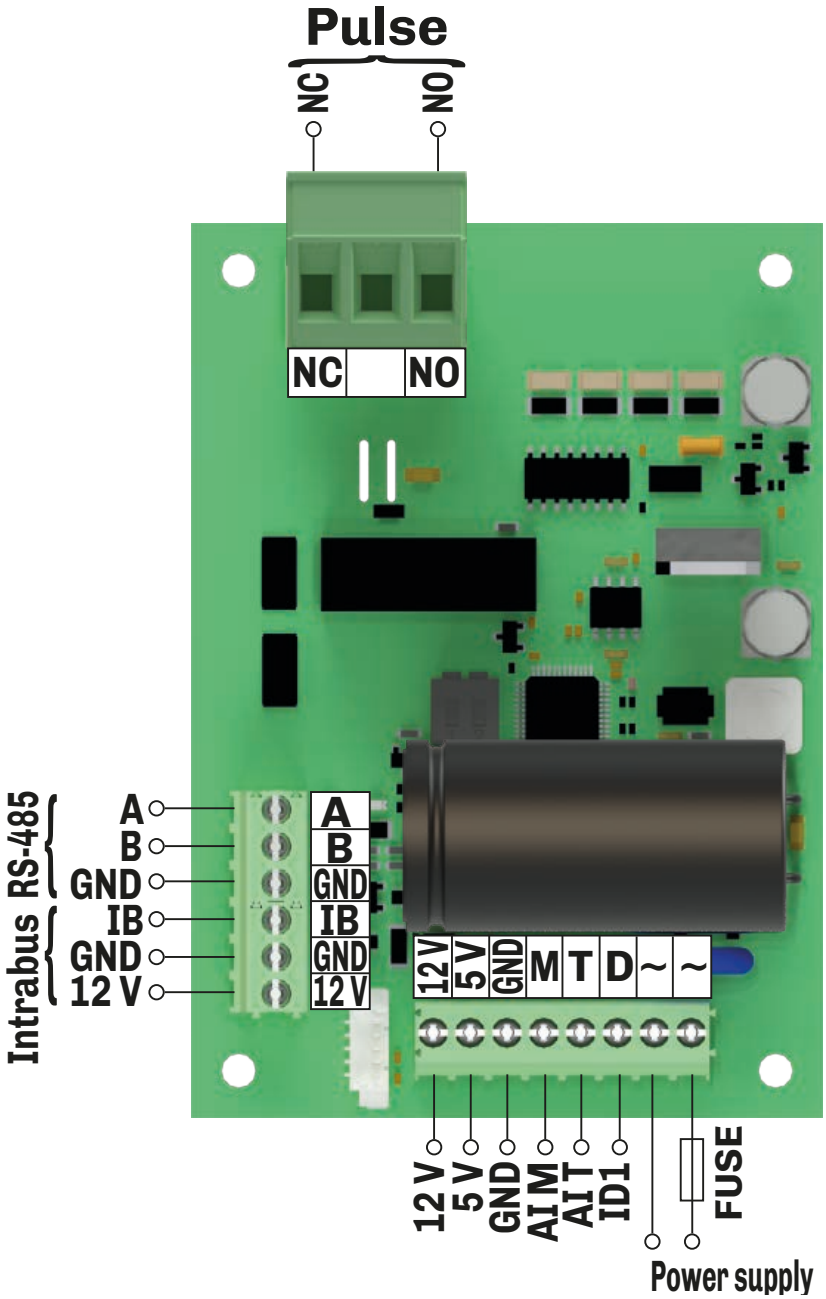


***FIG. 5. EVDRIVE05 Pulse** connection diagram*

TERMINALS			
≂	Power Supply Input	+5V GND	Power supply 0...5 V ratiometric transducers (5 Vdc ±5 %, 40 mA maximum)
GND ID1	**ID1** digital input	NO NC	Output for connection to pulse valve
GND AI T	**AI T** analogue input	IB GND 12 V	Intrabus serial line connection
GND AI M	**AI M** analogue input	A B GND	RS-485 serial line connection
+12V GND	Power supply 0...20 mA/4...20 mA/0...10 V transducers (12 Vdc ±10 %, 60 mA maximum)		

5. USER INTERFACE

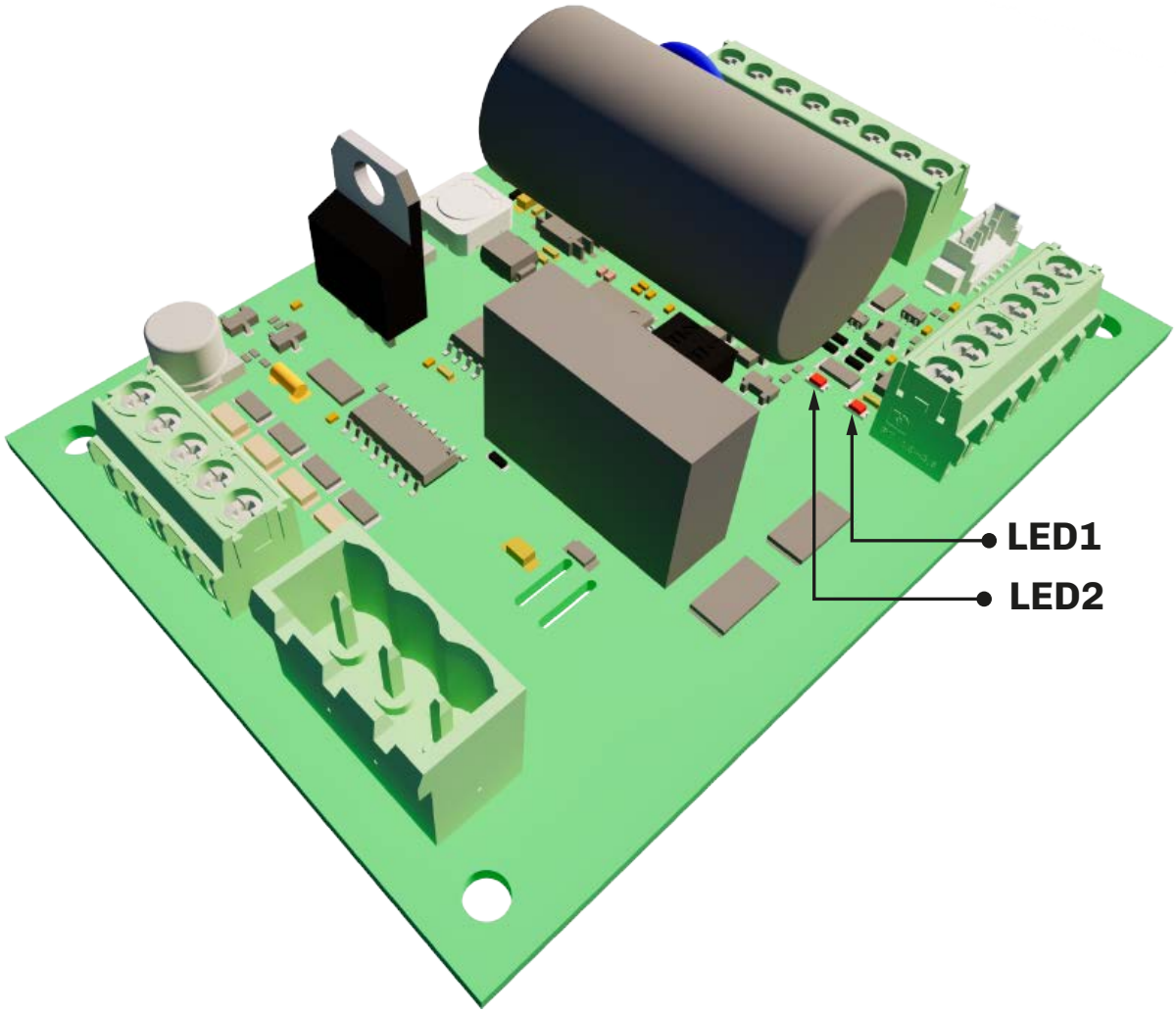


FIG. 6. *LED* ***EVDRIVE05***

5.1 HOW LEDs WORK

LED	Lit steadily	Flashing rapidly	Flashing slowly	OFF
LED 1	Positioning completed (EEV position <5 %)	EEV positioning in progress	Positioning completed (EEV position >95 %)	Positioning completed (5 % < EEV position <95 %)
LED 2	Alarm with manual reset ON	---	Alarm with automatic reset ON	In all other cases

6. MACHINE STATUSES

6.1 INTRODUCTION

This chapter describes the regulation status of the machine.

6.2 MACHINE REGULATION STATUSES

Status	Description
Initialising	Acquiring EEV parameters
Awaiting sync completion	Waiting for re-sync to complete
Awaiting positioning end	Waiting for current positioning process to end
Alarm	Valve in alarm status
Standby	Waiting for EEV enabling
Positioning device	Analogue positioning device control
Manual	Manual control
Equalisation	Equalisation phase in progress
Start-up	Start-up phase in progress
Algorithm	Regulation algorithm enabling Control algorithm in progress

6.2.1 Initialising

Initial status used to carry out the initial synchronisation phase for unipolar valves only.

6.2.2 Awaiting sync completion

EVDRIVE05 waits for valve synchronisation to be completed and moves on to the next status.

6.2.3 Awaiting positioning end

EVDRIVE05 waits for valve positioning to be completed at 0 absolute steps and moves on to the next status.

6.2.4 Standby

When the valve is disabled and has completed positioning it stops in this status.

If the probe value measurements have been acquired correctly and valve enabling is active, it moves on to the positioning device status, or to the equalising status depending on the regulation algorithm selected.

6.2.5 Positioning device/Analogue

EVDRIVE05 uses the value of the multifunctional probe linearised between its minimum and maximum, according to its configuration, to move the valve between 0 % and 100 %.

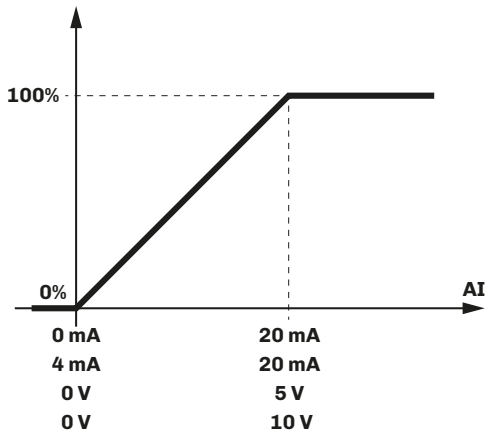


FIG. 7. *Positioning device/Analogue status operation*

6.2.6 Equalisation (phase 1) / Stabilisation (phase 2)

Before starting regulation, two phases must be carried out, the first being Equalisation and the second Start-up.

The equalisation phase is intended to equalise pressure in the circuit before the compressor is switched on, while the stabilisation phase is used to start regulation to a specific valve opening value.

If the delay is at zero, move on to the next phase without carrying out the current phase.

The machine only moves from Equalisation status to Stabilisation status once the phase is complete.

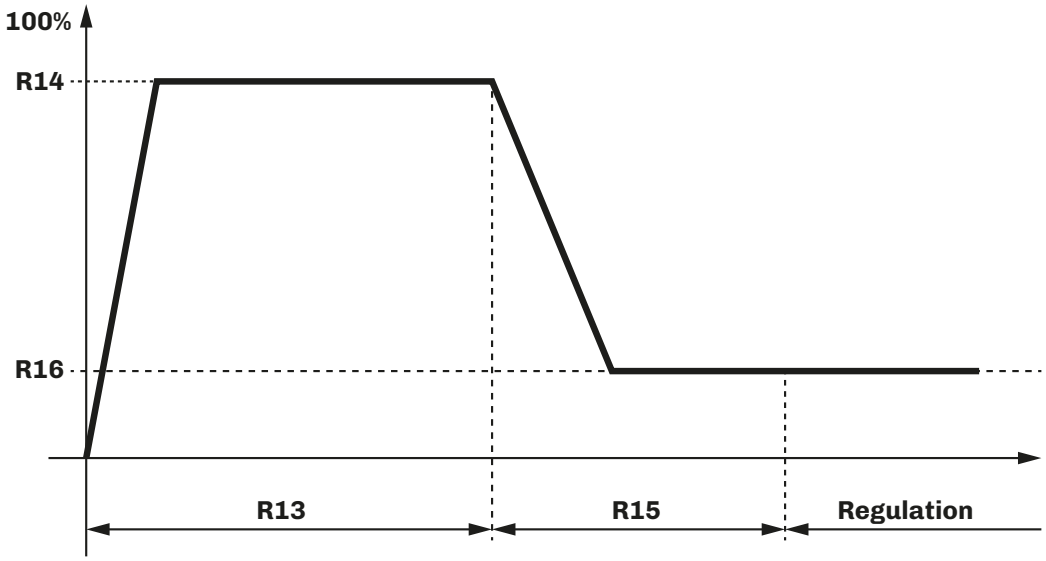


FIG. 8. *Equalisation/stabilisation status operation*

6.3 MANUAL

The valve position can be adjusted by setting the value in parameter **R25** *Percentage position of the valve in manual mode* to maintain this value when the board restarts, otherwise set the machine status to **S25** *Manual positioning setpoint*.

NOTICE
MALFUNCTIONING OF THE EQUIPMENT Writing continuously to R07 may damage the EVDRIVE05 memory and compromise device operation.

6.4 ALGORITHM

EVDRIVE05 is working properly in the selected algorithm.

7. FUNCTIONS

7.1 VALVE ENABLING

To allow regulation with **EVDrive**, regulation must be enabled for the valve.
Enabling can take place in two ways:

- Via a digital input configured as valve enable:
  - **I01** = ±1;
- Via serial command (Intrabus or Modbus) (if digital inputs **I01** = 0), by writing 1 in the register:
  - **S21A** (Remote enable command);

7.2 RE-SYNCING

Re-syncing is used to align the relevant valve at 0 % opening (zero steps), so that no steps are missed during regulation.

Re-sync activation takes place:

- At each power-on (power-on via power supply connection) of the **EVDRIVE05** (full sync);
- If set, at each interval **P13** (partial synchronisation);
- Via serial command (Intrabus or Modbus)
  - **S22** (Remote enable command);

7.2.1 Full sync

At each power-on **EVDrive** closes the valve with the **Absolute steps** value (see chapter ***"10. VALVE CONFIGURATION" ON PAGE 35***).

7.2.2 Partial sync

Partial syncing only takes place when the valve is disabled. **EVDrive** closes the valve at 0 steps and then with a further 10 % of its maximum steps, but no greater than the **Absolute steps** value (see chapter ***"10. VALVE CONFIGURATION" ON PAGE 35***).

7.3 LIMITING VALVE OPENING

EVDRIVE05 manages the overheating value at the evaporator outlet by limiting valve opening.

The configuration parameters are:

Par.	Description	MU	Range
P11	Minimum valve opening limit.	%	0...50
P12	Maximum valve opening limit.	%	50...100

The valve opening is linearised between 0 % and the value of parameter **P12**.

If the driver requests a smaller output than **P11**, the output value is limited to the minimum valve opening **P11**.

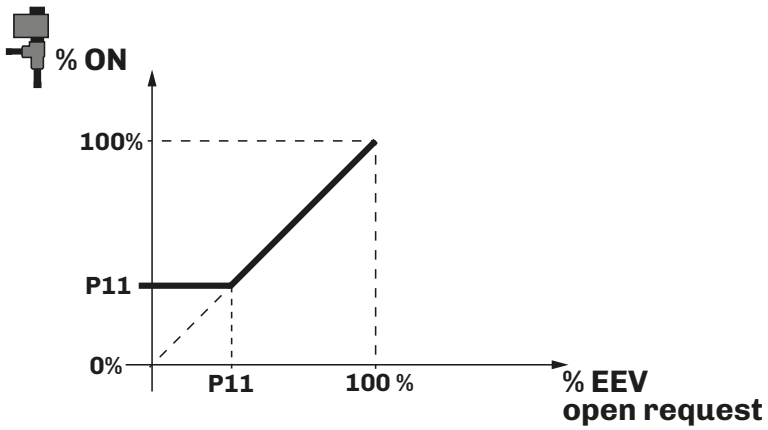


FIG. 9. *Minimum valve opening limit operation*

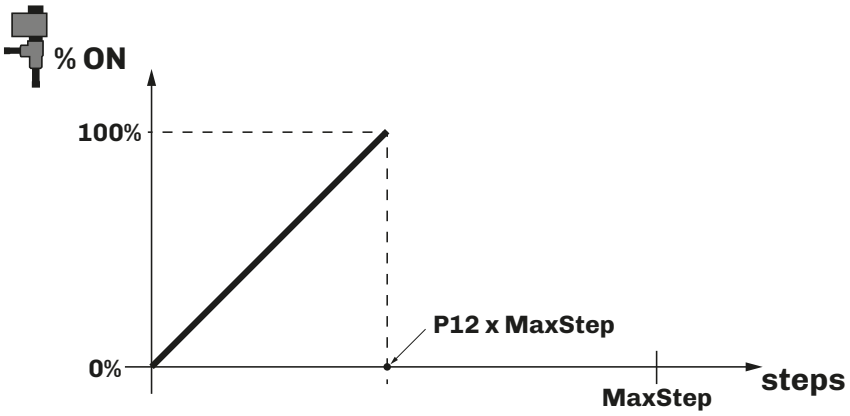


FIG. 10. *Maximum valve opening limit operation*

7.4 OPERATION WITH SHARED PRESSURE PROBE

If the application anticipates the use of two or more **EVDRIVE05** devices, the value detected by the pressure probe for one of the drivers (in which the pressure probe is installed) can be shared with all the others.

In this operating mode, the **AI_M** and **AI_ T** inputs must be connected to only one **EVDRIVE05**, while only the **AI_ T** input may be connected to the other **EVDRIVE05** devices. The pressure value is shared remotely via Modbus serial line.

The various **EVDRIVE05** devices must be connected to a Modbus network.

EVDRIVE05 configuration with the pressure probe

Set parameter **R01** to one of the values shown in the following table in the **EVDRIVE05** with the pressure probe connected in order to share the read value via the Modbus serial line:

Par.	Description	MU	Range
R01	Valve operating mode. **...** **1** = SH mode; **2** = Economizer; **3** = EPR; **4** = Hot Gas Bypass; **5** = Positioning device; **6** = Manual.	-	-3...6

EVDRIVE05 configuration without the pressure probe

Set parameter **R01** to one of the values shown in the following table in the **EVDRIVE05** devices without the pressure probe connected in order to receive the read value via the Modbus serial line:

Par.	Description	MU	Range
R01	Valve operating mode. **-3** = EPR with shared pressure probe; **-2** = Economizer with shared pressure probe; **-1** = SH mode with shared pressure probe; **...**	-	-3...6

7.5 VALVE OPERATION IN DUTY CYCLE

EVDRIVE05 can be used to manage motorised electronic expansion valves which need to run in duty cycle mode, so as to protect that valve from overheating.

The configuration parameters are:

Par.	Description	MU	Range
P14	Duty cycle.	%	5...100

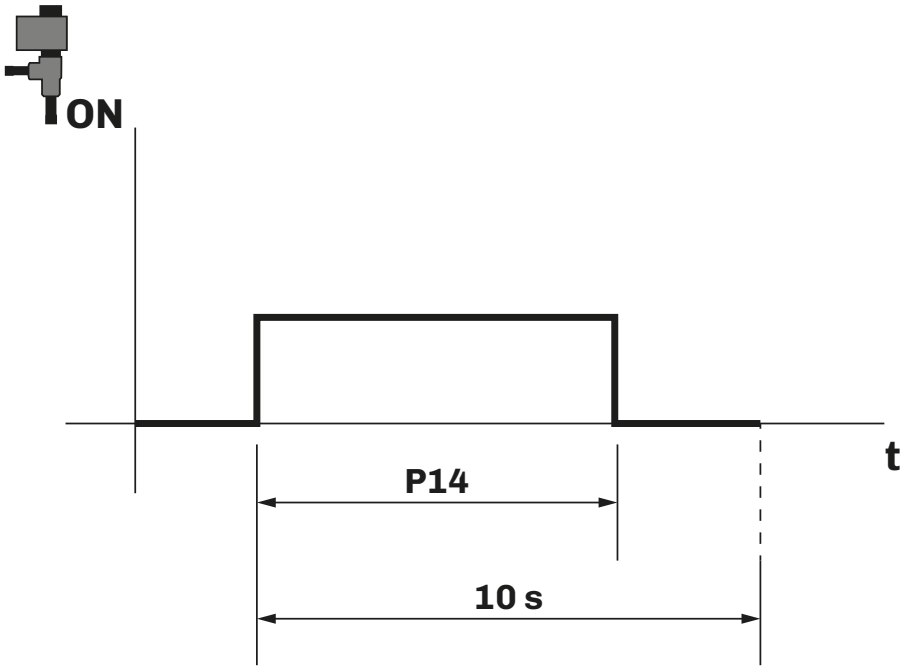


FIG. 11. *Valve operation in duty cycle*

8. REGULATION

8.1 INTRODUCTION

EVDRIVE05 can be set to different operating modes by configuring parameter **R01**.

Par.	Description	MU	Range
R01	Valve operating mode. **-3** = EPR with shared pressure probe; **-2** = Economizer with shared pressure probe; **-1** = SH mode with shared pressure probe; **0** = No control; **1** = SH mode; **2** = Economizer; **3** = EPR; **4** = Hot Gas Bypass; **5** = Positioning device; **6** = Manual;	-	-3...6

8.2 CONNECTING INPUTS ACCORDING TO REGULATION TYPE

	AI M input	AI T input
---	Not used	Not used
SH	**Used for regulation**	**Used for regulation**
Economizer	**Used for regulation**	**Used for regulation**
Pressure/Temperature	**Used for regulation**	Not used
Hot Gas Bypass	Not used	**Used for regulation**
Positioner	**Used for regulation**	Not used
Manual	Not used	Not used
Remote control	Not used	**Used for regulation**

8.3 SH/ECONOMIZER OVERHEATING REGULATION

8.3.1 SH

SH regulation can be used to keep the overheating temperature at a selected value.

EVDRIVE05 calculates the process overheating using the two analogue inputs **AI M** (evaporation pressure/temperature sensor) and **AI T** (intake temperature probe).

It uses a PID regulator to modulate the valve opening so that overheating reaches the setpoint **R05**.

When using a pressure probe, the measured value is converted into the corresponding temperature and then compared with the intake probe reading. Conversely, when using a temperature probe, the measured value is taken as it is, without any conversion, and is compared directly with the value measured by the intake sensor.

8.3.2 Economizer

The economizer is an auxiliary heat exchanger that evaporates part of the liquid and uses the steam generated to cool the compressor head.

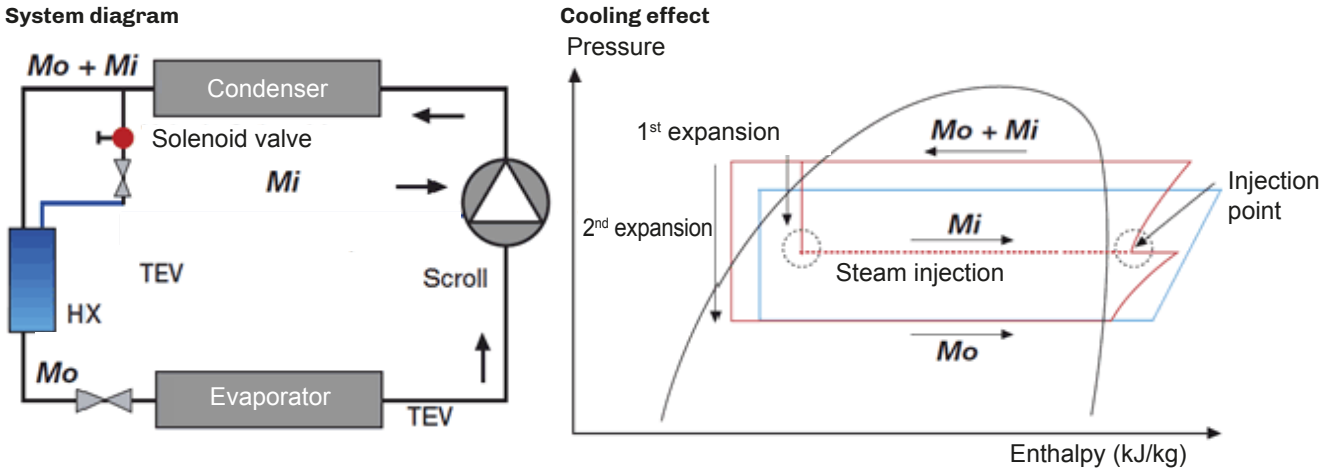


FIG. 12. *Economizer operation*

The configuration parameters are:

Par.	Description	MU	Range
R01	Valve operating mode. **-3** = EPR with shared pressure probe; **-2** = Economizer with shared pressure probe; **-1** = SH mode with shared pressure probe; **0** = No control; **1** = SH mode; **2** = Economizer; **3** = EPR; **4** = Hot Gas Bypass; **5** = Positioning device; **6** = Manual.	-	-3...6
R15	Valve stabilisation time.	s	0...250
R16	Valve stabilisation position.	%	0...100
R05	Valve regulation setpoint.	K/R or °C/°F	**R17** ...**R18**
R02	Valve PID proportional band.	K/R	0.1...999
R03	Valve PID integral time.	s	0...999
R04	Valve PID derivative time.	s	0...999
R06	Valve neutral zone threshold.	K/R	0...**R07**
R07	Valve proportional band threshold constant.	K/R	**R06**...**R08**
R08	Low regulation temperature threshold. (Only applies when **R01** = 1 and/or **R01** = 2).	K/R	1.0...99.9
R09	High regulation temperature threshold.	K/R	-58.0...80.0
R10	Valve fast action level.	%	1...100

Operation

The algorithm uses various regulation parameters, depending on the area of operation:

- If SH is in the *Neutral zone*, no regulation takes place;
- If SH is in the *Smart band*, a smart regulator is used (P constant);
- If SH is in the *Normal Control band*, a PID regulator is used;
- If SH is in the *Fast Action band*, a fast action PID regulator algorithm is used.

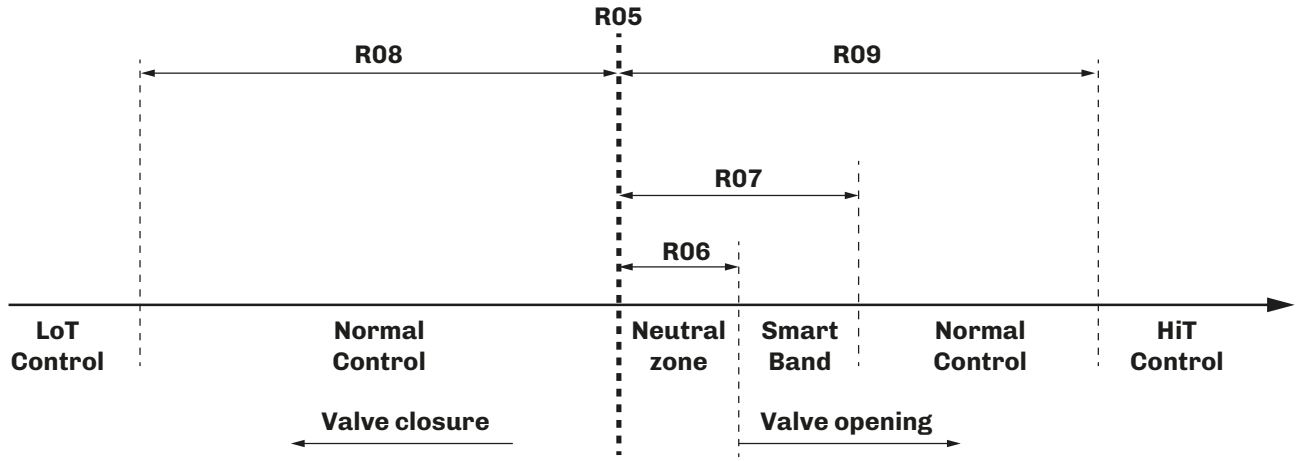


FIG. 13. *Operation*

8.3.3 Stable SH minimum

If the SH value remains stable (within the neutral regulation zone) for a time **R20**, the **EVDRIVE05** reduces the SH setpoint by 0.1 K.

The procedure may be repeated until the SH setpoint reaches value **R17**.

In the event of unstable regulation due to exceeding the maximum number of excursions into and out of the neutral zone **R22**, or exceeding the maximum time R21, the SH setpoint can be increased by 0.5 K until the original SH setpoint parameter is reached.

Excursions into and out of the neutral zone that take place at a lower frequency than the time spent in this band **R20** are not counted.

The configuration parameters are:

Par.	Description	MU	Range
R17	Minimum value that can be assigned to the regulation setpoint.	---	-58.0...99.9
R13	Equalisation time.	s	0...250
R21	Maximum time spent outside minSH band.	min	0...250
R22	Number of oscillations per minSH.	---	0...100

8.4 HOT GAS BYPASS ALGORITHM

The Hot Gas Bypass (HGB) algorithm allows the regulation temperature to be held at a setpoint **R22**.

The configuration parameters are:

Par.	Description	MU	Range
R05	Valve regulation setpoint.	K/R or °C/°F	**R17** ...**R18**
R02	Valve PID proportional band.	K/R	0.1...999
R03	Valve PID integral time.	s	0...999
R04	Valve PID derivative time.	s	0...999
R06	Valve neutral zone threshold.	K/R	0...**R07**
R07	Valve proportional band threshold constant.	K/R	**R06**...**R08**
R08	Low regulation temperature threshold. (Only applies when **R01** = 1 and/or **R01** = 2).	K/R	1.0...99.9
R09	High regulation temperature threshold.	K/R	-58.0...80.0

8.4.1 Operation

The algorithm uses various regulation parameters, depending on the area of operation:

- If SH is in the *Neutral zone*, no regulation takes place;
- If SH is in the *Smart band*, a smart regulator is used (P constant);
- If SH is in the *Normal Control band*, a PID regulator is used;
- If SH is in the *Fast Action band*, a fast action PID regulator algorithm is used.

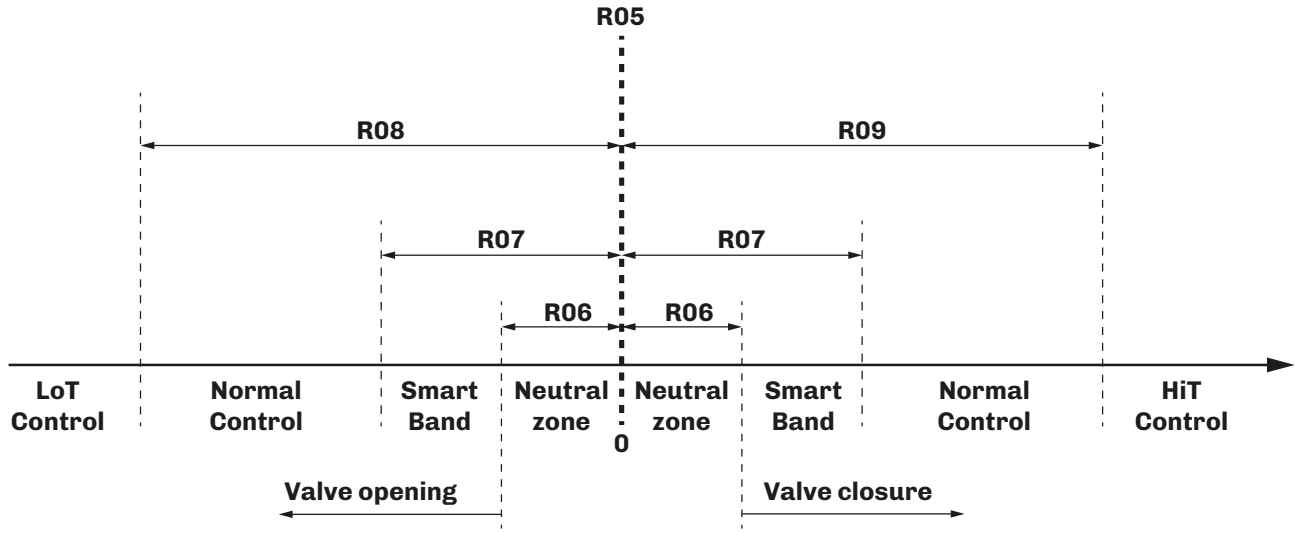


***FIG. 14. Hot Gas Bypass** operation*

8.5 EVAPORATOR PRESSURE REGULATOR (EPR)

To use the evaporator pressure regulator (EPR), you need to connect the pressure/temperature probe.

The algorithm keeps the temperature - and therefore the pressure reading - steady.

The regulator reading is provided by the multifunctional probe, which can be configured as both a pressure probe and a temperature probe. If the probe is configured in terms of pressure, a conversion into the corresponding temperature is carried out in accordance with the selected gas.

8.5.1 Operation

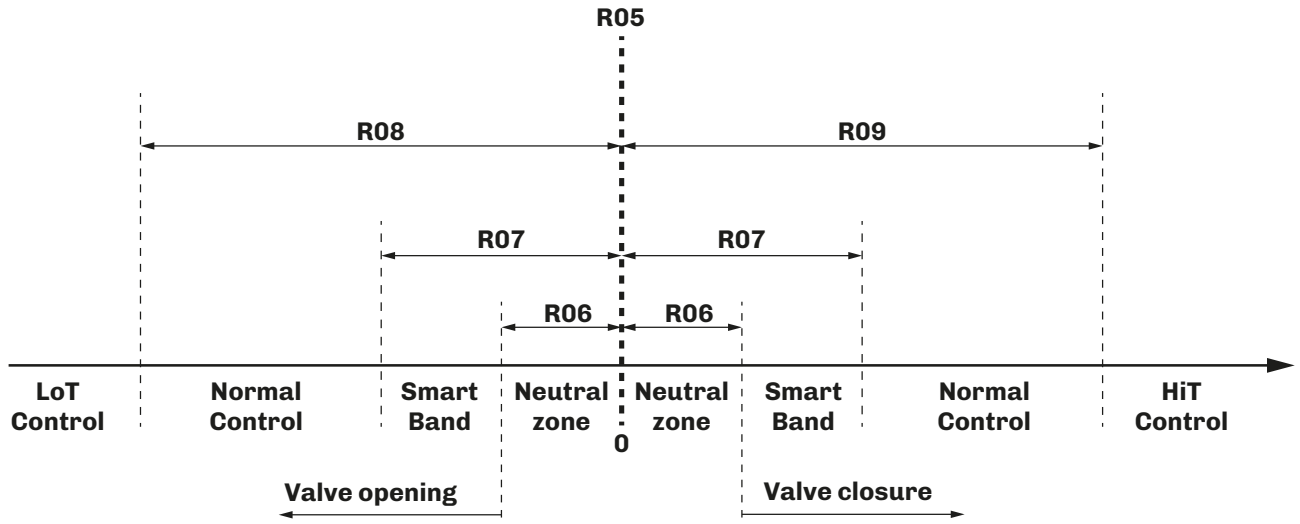


FIG. 15. *EPR operation*

8.6 AHIT | HIGH REGULATION TEMPERATURE ALARM

This alarm is only managed if the High Temperature Alarm Delay parameter (**A05**) ≠ 0. The alarm resets automatically.

In SH, HGB, Economizer or Constant temperature control, the alarm is activated when:

- Regulation temperature > High regulation temperature threshold (**R09**)
- High temperature alarm delay elapsed (**A05**)

The alarm resets when:

- Regulation temperature > High regulation temperature threshold (**R09**) - High Temperature Alarm Hysteresis (**A04**)

Fast action is triggered when:

- Regulation temperature > High regulation temperature threshold (**R09**)

Fast action is not active when:

- Regulation temperature < High regulation temperature threshold (**R09**)

8.7 ALOT | LOW REGULATION TEMPERATURE ALARM

This alarm is only managed if the Low Temperature Alarm Delay parameter (**A03**) ≠ 0. The alarm resets automatically.

In SH, HGB, Economizer or Constant temperature control, the alarm is activated when:

- Regulation temperature < Low regulation temperature threshold (**R08**)
- Low temperature alarm delay elapsed (**A03**)

The alarm resets when:

- Regulation temperature > Low regulation temperature threshold (**R08**) - Low temperature alarm hysteresis (**A02**)

Fast action is activated when:

- Regulation temperature < Low regulation temperature threshold (**R08**)

Fast action is not active when:

- Regulation temperature > Low regulation temperature threshold (**R08**)

8.8 MOP | HIGH PRESSURE ALARM

This alarm is only managed if the MOP Alarm Delay parameter (**A12**) ≠ 0. The alarm resets automatically.

In SH and Economizer control, the alarm is activated when the MOP bypass time (A19**A16**) from PID activation has elapsed and:

- Evaporation temperature > MOP temperature (**A10**)
- MOP alarm delay elapsed (**A12**)

The alarm resets when:

- Evaporation temperature > MOP temperature (**A10**) + MOP Alarm Hysteresis (**A11**)

MOP regulation active with:

- Evaporation temperature > MOP temperature (**A10**);

MOP regulation not active if:

- Evaporation temperature < MOP temperature (**A10**).

As soon as the threshold is passed once the bypass time has elapsed, the following occurs:

- **EVDRIVE05** changes the SH Setpoint. The parameters of this algorithm are MOP Band (**A14**), MOP algorithm filter time constant (**A15**), Maximum applicable MOP correction (**A13**). This algorithm is only active if the MOP Alarm Band parameter (**A14**) ≠ 0;
- **EVDRIVE05** closes the MOP Alarm Forced Decrease valve (**A17**) every MOP Alarm Forced Decrease Time (**A18**). This algorithm is only active if the MOP Alarm Band parameter (**A17**) ≠ 0.

The alarm is indicated if the MOP Alarm Delay time (**A12**) elapses.

8.9 LOP | LOW PRESSURE ALARM

This alarm is only managed if the LOP Alarm Delay parameter (**A08**) is not 0. The alarm resets automatically.
In SH and Economizer control, the alarm is activated when the bypass time from PID activation has elapsed and:

- Evaporation temperature < LOP temperature (**A06**)
- LOP alarm delay elapsed (**A08**)

The alarm resets when:

- Evaporation temperature > LOP temperature (**A06**) + LOP Alarm Hysteresis (**A07**).

Regulation is active if the alarm is triggered.

As soon as the threshold is exceeded, a control algorithm is also activated and the alarm is indicated if the LOP Alarm Delay time (**A08**) elapses.

If the LOP alarm occurs during the algorithm phase, regulation stops the valve when:

- The LOP alarm is triggered;
- The overheating value is greater than 0.5 K;
- The algorithm wants to close the valve.

If the LOP alarm occurs during the start-up phase (when the evaporation temperature is effectively low), the algorithm forces valve opening.

If the LOP alarm is reset, **EVDRIVE05** stops the valve. This phase can be optimised by configuring the valve opening correctly in the start-up parameters (Equalisation position (**R14**), Equalisation time (**R13**), Start-up position (**R16**), Start-up time (**R15**).

9. PARAMETERS

9.1 DESCRIPTION OF COLUMNS IN THE TABLE OF PARAMETERS

- **Par**.: list of configurable device parameters;
- **Description**: indicates parameter operation and any possible selections;
- **MU**: measurement unit relating to the parameter;
- **Range**: describes the interval of values that the parameter can assume. This can be correlated with other instrument parameters (indicated with the parameter code).
  NOTE: *if the actual value is outside the permitted limits for that parameter (for example, because other parameters defining the aforementioned limits have been altered), the value of the violated limit is displayed instead of the actual value;*
- **Default**: indicates the pre-set factory configuration;
- **PW**: indicates the access level for the parameter:
  - **U** = User parameters;
  - **I** = Installer parameters;
  - **M** = Maintenance parameters;
  - **C** = Construction parameters.

9.2 TABLE OF CONFIGURATION PARAMETERS

Par.	PW	Description	MU	Range	Default
	REGULATION group				
R01	I	Valve A operating mode. **-3** = EPR with shared pressure probe; **-2** = Economizer with shared pressure probe; **-1** = SH mode with shared pressure probe; **0** = No control; **1** = SH mode; **2** = Economizer; **3** = EPR; **4** = Hot Gas Bypass; **5** = Positioning device; **6** = Manual.	---	-3...6	1
R02	I	PID proportional band.	K/R	0.1...999	40.0
R03	I	PID integral time.	s	0...999	120
R04	I	PID derivative time.	s	0...999	30
R05	U	Valve regulation setpoint.	K/R or °C/°F	**R17**...**R18**	6.0
R06	I	Neutral zone threshold.	K/R	0...**R07**	1.0
R07	I	Proportional band threshold constant.	K/R	**R06**...**R08**	3.0
R08	U	Low regulation temperature threshold. (Only applies when **R01** = 1 and/or **R01** = 2).	K/R	1.0...99.9	3.0
R09	U	High regulation temperature threshold.	K/R	-58.0...80.0	10.0
R10	U	Fast action level.	%	1...100	70
R11	I	Standby position.	%	0...100	0
R12	I	Position in error.	%	-1...100	0
R13	U	Equalisation time.	s	0...250	5
R14	U	Equalisation position.	%	0...100	100
R15	U	Stabilisation time.	s	0...250	30
R16	I	Stabilisation position.	%	0...100	50
R17	I	Minimum setpoint.	K/R or °C/°F	-58.0...**R05**	1.0
R18	I	Maximum setpoint.	K/R or °C/°F	**R05**...99.9	10.0
R20	I	Minimum stable setpoint control time.	min	0...250	5
R21	I	Maximum stable SH control time.	min	0...250	10
R22	I	Number of oscillations for minimum stable SH control.	num	0...100	0
R23	U	**AI T** temperature offset.	°C/°F	-10.0...10.0	0.0
R24	U	**AI M** temperature offset.	°C/°F	-10.0...10.0	0.0

Par.	PW	Description	MU	Range	Default
R25	U	**AI M** pressure offset.	bar/10*psi	-10.00...10.00	0.00
R26	U	Manual valve percentage position.	%	0...100	0
	SYSTEM CONFIGURATION group				
P01	I	Refrigerant gas type. **0** = R22; **1** = r134a; **2** = r402a; **3** = r404a3; **4** = r407a; **5** = r407c; **6** = r410a; **7** = r417a; **8** = r422a; **9** = r422d; **10** = r507a; **11** = r744; **12** = r438a; **13** = r401b; **14** = r290; **15** = r717; **16** = r1270; **17** = r32; **18** = r407f; **19** = r1234ze; **20** = r1234yf; **21** = r723; **22** = r452a; **23** = r513a; **24** = r454b; **25** = r448a; **26** = r449a; **27** = r23; **28** = R1233ZDE.	---	0...28	0
P02	I	Pressure unit of measure. **0** = Bar; **1** = psi.	---	0/1	0
P03	I	Temperature unit of measure. **0** = °C/K; **1** = °F/R.	---	0/1	0
P04	I	Pulse valve period.	s	1...250	10
P05	I	Valve selection. **0** = Generic valve; **1** = Sanhua DPF; **2** = Danfoss ETS6; **3** = Sporlan SER-U; **4** = Sporlan ESX; **5** = Sporlan EDEV B/C; **6** = Alco EXM/L.	---	0...6	0
P07	I	Generic valve minimum steps.	steps	0...**P08**	0
P08	I	Generic valve maximum steps.	steps	**P07**...10000	1000
P09	I	Extra steps to close generic valve fully.	steps	**P08**...10000	1200
P10	I	Generic valve step rate.	step/s	**1...1000**	100
P11	U	Minimum valve opening limit.	%	0...100	0
P12	U	Maximum valve opening limit.	%	50...100	100
P13	I	Re-sync interval.	h	0...1000	24
P14	I	Generic valve duty cycle.	%	5...100	100
P18	I	EPoCA log sampling interval.	min	0...255	5
P19	I	Email notification of alarms in EPoCA. **0** = Disabled; **1** = Enabled.	-	0/1	0
	ALARM CONFIGURATION group				
A01	U	Communication alarm delay.	s	0...250	120

Par.	PW	Description	MU	Range	Default
A02	U	Low temperature alarm hysteresis.	K/R	0.0...25.0	0.5
A03	U	Low temperature alarm delay.	s	0...250	0
A04	U	High temperature alarm hysteresis.	K/R	0.0...25.0	1.0
A05	U	High temperature alarm delay.	s	0...250	0
A06	U	LOP temperature.	°C/°F	-40.0...105.0	-20.0
A07	U	LOP hysteresis.	K/R	0...10	1.0
A08	U	LOP delay.	s	0...250	0
A09	U	Motor alarm delay.	s	0...250	0
A10	U	MOP temperature.	°C/°F	-40.0...105.0	12.0
A11	U	MOP hysteresis.	K/R	0.0...10.0	1.0
A12	U	MOP delay.	s	0...250	30
A13	U	Maximum applicable MOP correction.	K/R	0...250	70
A14	U	MOP algorithm band.	K/R	0...250	80
A15	U	MOP algorithm filter.	10*s	0...250	15
A16	U	MOP bypass.	s	0...250	30
A17	U	MOP alarm forced decrease.	%	0...100	0
A18	U	MOP alarm forced decrease time.	s	0...250	0
	I/O CONFIGURATION group				
I01	U	**DI1** function. **0** = Disabled; **±1** = Valve enable. **NOTE**: **"+"** indicates that the input is active if the contact is closed. **"-"** indicates that the input is active if the contact is open.	---	-1...1	1
I02	U	**DO1** function. **0** = No function; **±1** = Alarm; **±2** = Solenoid valve activation; **±3** = Re-sync request; **±4** = Remote; **NOTE**: **"+"** indicates that the output is active if the contact is closed. **"-"** indicates that the output is active if the contact is open.	---	-4...4	0
I03	I	**AI T** sensor type. **0** = Digital input; **1** = NTC probe; **6** = Pt1000 probe.	---	0...6	1
I04	I	**AI M** sensor type. **0** = Digital input; **1** = NTC probe; **6** = Pt1000 probe; **10** = Transducer 4...20 mA (0...10 barg); **11** = Transducer 4...20 mA (0...16 barg); **12** = Transducer 4...20 mA (0...30 barg); **13** = Transducer 4...20 mA (0...50 barg); **20** = Ratiometric transducer 0...5 V (0...7 barg); **21** = Ratiometric transducer 0...5 V (0...25 barg); **22** = Ratiometric transducer 0...5 V (0...60 barg); **30** = Custom transducer (probe_Scaling).	---	0...30	10
	CUSTOM INPUT CONFIGURATION group				
I05	I	**AI M** x-axis probe type. **0** = 0...20 mA; **1** = 4...20 mA; **2** = 0...5 V; **3** = 0...10 V; **4** = NTC.	---	0...4	1
I06	I	Maximum **AI M** x-axis value.	---	0.00...20.00	20.00
I07	I	Minimum **AI M** x-axis value.	---	0.00...20.00	0.00
I08	I	Maximum **AI M** y-axis value.	---	-32768...32767	0
I09	I	Minimum **AI M** y-axis value.	---	-327.68...327.67	0.00

Par.	PW	Description	MU	Range	Default
I11	U	Remote **AI T** sensor type. **2** = NTC; **7** = Pt1000; **99** = Digital input.	-	2...99	2
I12	U	Remote **AI M** remote sensor type. **2** = NTC; **3** = 0...20 mA; **4** = 4...20 mA; **5** = 0...5 V; **6** = 0...10 V; **7** = Pt1000; **99** = Digital input.	-	2...99	4
I13	U	**AI D** remote sensor type. **2** = NTC; **7** = Pt1000; **99** = Digital input.	-	2...99	99
	SERIAL COMMUNICATION PORT CONFIGURATION group				
C01	I	Modbus serial address.	---	1...247	1
C02	I	Modbus parity. **0** = None; **1** = Odd; **2** = Even.	---	0...2	2
C03	I	Modbus baud rate. **0** = 1200; **1** = 2400; **2** = 4800; **3** = 9600; **4** = 19200.	---	0...4	4
C04	I	Modbus stop bits. **0** = 1 stop bit; **1** = 2 stop bits.	---	0/1	0
C05	I	TTL serial address.	---	1...247	247
C06	I	TTL baud rate. **0** = 1200; **1** = 2400; **2** = 4800; **3** = 9600; **4** = 19200.	---	0...4	4
C07	I	TTL parity. **0** = None; **1** = Odd; **2** = Even.	---	0...2	0
C08	I	TTL stop bits. **0** = 1 stop bit; **1** = 2 stop bits.	---	0/1	0
BLE	I	Epoca TTL usage.	---	0...247	0
C10	I	IB serial address. **0** = Node 7; **1** = Node 8.	---	0/1	0
	PASSWORD group				
C14	C	User password.	---	-32768...32767	426
C15	C	Maintenance password.	---	-32768...32767	824
C16	C	Manufacturer password.	---	-32768...32767	398

10. VALVE CONFIGURATION

10.1 INTRODUCTION

The configurations listed below are presented in compliance with the technical documentation from the corresponding manufacturers.
EVCO is not responsible for any changes made to the values by the manufacturers. Always refer to the latest available version of the manufacturer's technical documentation.

10.2 CONFIGURATIONS

10.2.1 Unipolar valves

P04	EEV	Minimum steps [Step]	Maximum steps [Step]	Absolute steps [Step]	Nominal speed [Step/s]	Maximum current [mA]	Stationary current [mA]
0	Custom valve	0	0	0	0	0	0
1	Sanhua DPF	0	250	300	45	260	0
2	Danfoss ETS6	0	240	260	25	260	0
3	Sporlan SER-U	0	800	1500	200	120	0
4	Sporlan ESX	24	224	300	40	260	0
5	Sporlan EDEV B/C	0	800	1250	200	120	0
6	Alco EXM/L uni	16	250	350	45	130	0

11. DIAGNOSTICS

The table below lists alarms with corresponding solutions. Warnings are made via alert LED ⚠ lighting up. Each alarm is recorded in the Alarms menu.

11.1 TABLE OF ALARMS

Code	Description	Cause	Effects	Solution
AL01	Alarm: valve communication	No communication with Master device for time > **A01**	• Valve in alarm position • Regulation OFF	• Restore communication with the Master device • Automatic reset
AL02	Alarm: valve high regulation temperature	Regulation temperature > **R09** for time > **A05**	Protective action ON	• Check probe operation • Check system operation • Wait until temperatures < **R09-A04** • Automatic reset
AL03	Alarm: valve low regulation temperature	Regulation temperature < **R08** for time > **A03**	Protective action ON	• Check probe operation • Check system operation • Wait until temperatures > **R08+A02** • Automatic reset
AL04	Alarm: valve MOP high pressure	Saturation temperature > **A10** for time > **A12A**	• Protective action ON if **A12A** ≠ 0 • MOP forced decrease alarm triggered if **A12A** ≠ 0	• Check probe operation • Check system operation • Wait until the saturation temperature < **A10-A11** • Automatic reset
AL05	Alarm: valve A LOP low pressure	Saturation temperature < **A06** for time > **A08**	• Protective action ON • *If alarm in regulation*: valve stopped in current position *If alarm in start-up*: valve open	• Check probe operation • Check system operation • Wait until the saturation temperature > **A06+A07** • Automatic reset
AL07	AI T probe in error	• Probe not working • Probe not connected properly • Incorrect probe type	If regulation probe: valve in alarm position and regulation OFF	• Check the sensor type • Check the probe wiring • Change the probe type • Automatic reset
AL08	AI M probe in error		If regulation probe: valve in alarm position and regulation OFF	
AL09	Alarm: valve	• Valve motor not working • No connection	• Valve in alarm position • Regulation OFF	• Check the motor status and connections • Switch **EVDRIVE05** off then on again • Manual reset
AL10	Alarm: memory	Device memory in error	Default values of the parameters restored	• Reconfigure the parameters • Contact EVCO technical support • Automatic reset
AL11	Alarm: valve A configuration	Valve parameters configured incorrectly	• Valve in alarm position • Regulation OFF	• Check parameter configuration • Switch **EVDRIVE05** off then on again • Manual reset

12. MODBUS RTU FUNCTIONS AND RESOURCES

12.1 INTRODUCTION

Modbus RTU (Remote Terminal Unit) protocol is a means of communication which allows data exchange between a computer and programmable logic controllers.
This protocol is based on the exchange of messages between master-slave and client-server devices. Master devices can receive information from slaves and write to their registers, while slave devices cannot initiate any information transfer until they receive a request from the slave device.
Modbus communication is used in industrial automation systems (IAS) and in the construction of building management systems (BMS). Modbus protocol is widely utilised due to the fact it is easy to use, very reliable and has an open source code that can be used royalty-free on any application or device.

Modbus RTU is the most common application and uses CRC error detection and binary encoding.

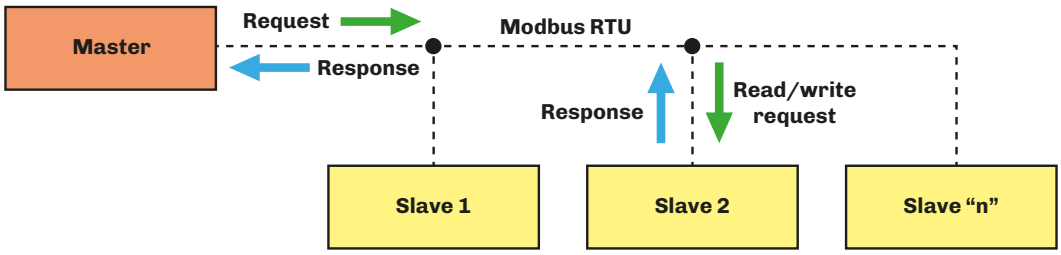


FIG. 16. *Diagram showing message exchange in a Modbus communication*

Modbus protocol establishes a Protocol Data Unit (PDU) independent from the communication layer below it, introducing some additional fields specified on the Application Data Unit (ADU) (***"FIG. 17. FRAMING OF A MESSAGE USING MODBUS PROTOCOL" ON PAGE 37***) to specific buses and networks.

Devices such as PLCs (Programmable Logic Controller), HMIs (Human Machine Interface), control panels, drivers, motion controllers, I/O devices, etc. can use Modbus to begin a remote procedure, and the protocol is often used to connect a supervising computer with a Remote Terminal Unit in a supervision, control and data acquisition (SCADA) system.

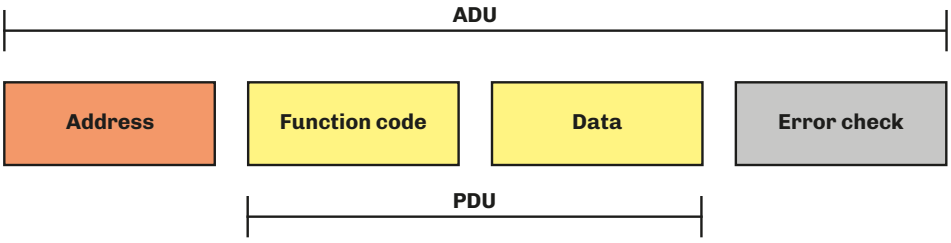


FIG. 17. *Framing of a message using Modbus protocol*

For further information relating to Modbus protocol, visit the official Modbus website: www.modbus.org.

12.2 MODBUS MESSAGE STRUCTURE

Modbus RTU protocol requires the message to start with a silent time interval of at least 3.5 character times. This feature is often implemented by executing a time interval of multiple of character times at the baud rate used in the network. The characters available for each field are in binary form.

A description of the structure of a Modbus RTU message is provided below.

Start	Address	Function	Data	CRC	Stop
3.5 x character time	8 bit	8 bit	(N x 8 bit)	16 bit	3.5 x character time
Time period in which data must not be exchanged over the communication bus, to allow the connected instruments to recognise the end of one message and the start of the next	Corresponds to the address for the device with which the master has established dialogue; this is a value between 1...247. The address 0 is reserved for the broadcast message sent to all slave devices	Code for the function to execute or which has been executed	Contains the data sent by the master or sent back by the slave as a response to a question	Allows the master and the slave to check whether any errors are present during communication, and if there are, to ignore the message received	Time period in which data must not be exchanged over the communication bus, to allow the connected instruments to recognise the end of one message and the start of the next

12.3 MODBUS FUNCTIONS AND REGISTERS

The Modbus registers for the device are organised around the four types of basic data reference indicated above, and this type of data is further identified by the first number of the address.

12.3.1 Available Modbus commands and data areas

The commands implemented are as follows:

Command	Description
03 (hex 0x03)	Resource reading command
06 (hex 0x06)	Resource writing command

12.4 ADDRESS CONFIGURATION

The RS-485 communication serial port can be used to configure the device, the parameters, the statuses and the Modbus variables and to monitor device operation using Modbus protocol.

The device address in a Modbus message is set by parameter **C01**.

Serial line configuration parameters, which can be accessed via the user interface menu, are:

Par.	Description	MU	Range
C01	Modbus serial address.	---	1...247
C02	Modbus parity. **0** = None; **1** = Odd; **2** = Even.	---	0...2
C03	Modbus baud rate. **0** = 1200; **1** = 2400; **2** = 4800; **3** = 9600; **4** = 19200.	---	0...4
C04	Modbus stop bits. **0** = 1 stop bit; **1** = 2 stop bits.	---	0/1

The RS-485 RTU serial line has the following characteristics:

- RTU mode;
- Bit: 8 bit

12.5 CONNECTIONS

For the entire system to work properly, including the RS-485 RTU serial line, observe the instructions provided in chapter ***"4. ELECTRICAL CONNECTIONS" ON PAGE 15***.

In particular, take care to make the connections correctly, observing the instructions in section ***"4.2 WIRING DIAGRAM" ON PAGE 17***

12.6 MODBUS TABLE CONTENT

Table content description

The table below contains the information required to access the resources properly and directly.
There are two tables:

- The Modbus address table, which contains all the configuration parameters for the device and the corresponding Modbus addresses;
- Modbus resource table, which contains all the status (I/O) and alarm resources in the device memory.

Description of columns in the Table of addresses

- **Par.**: list of configurable device parameters;
- **Description**: indicates parameter operation and any possible selections;
- **MU**: measurement unit relating to the parameter;
- **Range**: describes the interval of values that the parameter can assume. This can be correlated with other instrument parameters (indicated with the parameter code).
  NOTE: if the actual value is outside the permitted limits for that parameter (for example, because other parameters defining the aforementioned limits have been altered), the value of the violated limit is displayed instead of the actual value;
- **Val. Par. Adr.**: Indicates the address of the Modbus register containing the resource you want to access;
- **Vis. Val. Par. Adr.:** Contains the address of the Modbus register containing the visibility value of the resource to be read or written in the device.
- **R/W:** Indicates the option of reading or writing the resource:
  - **R**: The resource is read-only;
  - **W**: The resource is write-only;
  - **R/W**: The resource can be both read and written.
- **CPL**: When the fields indicates Y, the value read by the register needs to be converted because the value represents a number with a sign. In the other cases the value is always positive or zero.
- **DATA SIZE**: Indicates the size in data bits:
  - **DWORD** = 32 bit
  - **DOUBLE** = 32 bit with sign
  - **SHORT** = 16 bit with sign
  - **WORD** = 16 bit
  - **Byte** = 8 bit
  - The "**n**" bits = 0...15 bit depending on the value of "n"

12.7 MODBUS ADDRESSES

12.7.1 Modbus parameter and address table

Par.	Description	Val. Par. Adr.	Filter value	R/W	DATA SIZE	CPL	MU	Range
	REGULATION group							
R01	Valve A operating mode. **-3** = EPR with shared pressure probe; **-2** = Economizer with shared pressure probe; **-1** = SH mode with shared pressure probe; **0** = No control; **1** = SH mode; **2** = Economizer; **3** = EPR; **4** = Hot Gas Bypass; **5** = Positioning device; **6** = Manual.	1536	---	R/W	SHORT	Y	---	-3...6
R02	PID proportional band.	1537	---	R/W	WORD	---	K/R	0.1...999
R03	PID integral time.	1538	---	R/W	WORD	---	s	0...999
R04	PID derivative time.	1539	---	R/W	WORD	---	s	0...999
R05	Setpoint.	1540	---	R/W	SHORT	Y	K/R or °C/°F	**R17**...**R18**
R06	Neutral zone threshold.	1541	---	R/W	BYTES	---	K/R	0...**R07**
R07	Proportional band threshold constant.	1542	---	R/W	BYTES	---	K/R	**R06**...**R08**
R08	Low regulation temperature threshold. (Only applies when **R01** = 1 and/or **R01** = 2).	1543	---	R/W	BYTES	---	K/R	1.0...99.9
R09	High regulation temperature threshold.	1544	---	R/W	SHORT	Y	K/R	-58.0...80.0
R10	Fast action level.	1545	---	R/W	BYTES	---	%	1...100
R11	Standby position.	1546	---	R/W	BYTES	---	%	0...100
R12	Position in error.	1547	---	R/W	SHORT	Y	%	-1...100
R13	Equalisation time.	1548	---	R/W	BYTES	---	s	0...250
R14	Equalisation position.	1549	---	R/W	BYTES	---	%	0...100
R15	Stabilisation time.	1550	---	R/W	BYTES	---	s	0...250
R16	Stabilisation position.	1551	---	R/W	BYTES	---	%	0...100
R17	Minimum setpoint.	1552	---	R/W	SHORT	Y	K/R or °C/°F	-58.0...**R18**
R18	Maximum setpoint.	1553	---	R/W	SHORT	Y	K/R or °C/°F	**R17**...99.9
R20	Minimum stable setpoint control time.	1555	---	R/W	BYTES	---	min	0...250
R21	Maximum stable SH control time.	1556	---	R/W	BYTES	---	min	0...250
R22	Number of oscillations for minimum stable SH control.	1557	---	R/W	BYTES	---	num	0...100
R23	**AI T** temperature offset.	1558	---	R/W	SHORT	Y	°C/°F	-10.0...10.0
R24	**AI M** temperature offset.	1559	---	R/W	SHORT	Y	°C/°F	-10.0...10.0
R25	**AI M** pressure offset.	1560	---	R/W	SHORT	Y	bar/10*psi	-10.00...10.00
R26	Manual valve percentage position.	1561	---	R/W	BYTES	---	%	0...100

Par.	Description	Val. Par. Adr.	Filter value	R/W	DATA SIZE	CPL	MU	Range
	SYSTEM CONFIGURATION group							
P01	Refrigerant gas type. **0** = R22; **1** = r134a; **2** = r402a; **3** = r404a3; **4** = r407a; **5** = r407c; **6** = r410a; **7** = r417a; **8** = r422a; **9** = r422d; **10** = r507a; **11** = r744; **12** = r438a; **13** = r401b; **14** = r290; **15** = r717; **16** = r1270; **17** = r32; **18** = r407f; **19** = r1234ze; **20** = r1234yf; **21** = r723; **22** = r452a; **23** = r513a; **24** = r454b; **25** = r448a; **26** = r449a; **27** = r23; **28** = R1233ZDE.	1584	---	R/W	BYTES	---	---	0...28
P02	Pressure unit of measure. **0** = Bar; **1** = Psi.	1585	---	R/W	1 BIT	---	---	0/1
P03	Temperature unit of measure. **0** = °C/K; **1** = °F/R.	1586	---	R/W	1 BIT	---	---	0/1
P04	Pulse valve period.	1587	---	R/W	BYTES	---	s	1...250
P05	Valve selection. **0** = Generic valve; **1** = Sanhua DPF; **2** = Danfoss ETS6; **3** = Sporlan SER-U; **4** = Sporlan ESX; **5** = Sporlan EDEV B/C; **6** = Alco EXM/L.	1588	---	R/W	BYTES	---	---	0...6
P07	Generic valve minimum steps.	1590	---	R/W		---	steps	0...**P08**
P08	Generic valve maximum steps.	1591	---	R/W	WORD	---	steps	**P07**...10000
P09	Extra steps for full generic valve closure.	1592	---	R/W	WORD	---	steps	**P08**...10000
P10	Generic valve step rate.	1593	---	R/W	WORD	---	step/s	1...1000
P11	Minimum valve opening limit.	1594	---	R/W	BYTES	---	%	0...100
P12	Maximum valve opening limit.	1595	---	R/W	BYTES	---	%	50...100
P13	Re-sync interval.	1596	---	R/W	WORD	---	h	0...1000
P14	Generic valve duty cycle.	1597	---	R/W	BYTES	---	%	5...100
P18	EPoCA log sampling interval.	1601	---	R/W	BYTES	---	min	0...255
P19	Email notification of alarms in EPoCA. **0** = Disabled; **1** = Enabled.	1602	---	R/W	1 BIT	---	-	0/1
	ALARM CONFIGURATION group							
A01	Communication alarm delay.	1632	---	R/W	BYTES	---	s	0...250
A02	Low temperature alarm hysteresis.	1633	---	R/W	BYTES	---	K/R	0.0...25.0
A03	Low temperature alarm delay.	1634	---	R/W	BYTES	---	s	0...250

Par.	Description	Val. Par. Adr.	Filter value	R/W	DATA SIZE	CPL	MU	Range
A04	High temperature alarm hysteresis.	1635	---	R/W	BYTES	---	K/R	0.0...25.0
A05	High temperature alarm delay.	1636	---	R/W	BYTES	---	s	0...250
A06	LOP temperature.	1637	---	R/W	SHORT	Y	°C/°F	-40.0...105.0
A07	LOP hysteresis.	1638	---	R/W	BYTES	---	K/R	0...10
A08	LOP delay.	1639	---	R/W	BYTES	---	s	0...250
A09	Motor alarm delay.	1640	---	R/W	BYTES	---	s	0...250
A10	MOP temperature.	1641	---	R/W	SHORT	Y	°C/°F	-40.0...105.0
A11	MOP hysteresis.	1642	---	R/W	BYTES	---	K/R	0.0...10.0
A12	MOP delay.	1643	---	R/W	BYTES	---	s	0...250
A13	Maximum applicable MOP correction.	1644	---	R/W	BYTES	---	K/R	0...250
A14	MOP algorithm band.	1645	---	R/W	BYTES	---	K/R	0...250
A15	MOP algorithm filter.	1646	---	R/W	BYTES	---	10*s	0...250
A16	MOP bypass.	1647	---	R/W	BYTES	---	s	0...250
A17	MOP alarm forced decrease.	1648	---	R/W	BYTES	---	%	0...100
A18	MOP alarm forced decrease time.	1649	---	R/W	BYTES	---	s	0...250
	I/O CONFIGURATION group							
I01	**DI1** function. **0** = Disabled; **±1** = Valve enable. **NOTE**: **"+"** indicates that the input is active if the contact is closed. **"-"** indicates that the input is active if the contact is open.	1680	---	R/W	SHORT	Y	---	-1...1
I02	**DO1** function. **0** = No function; **±1** = Alarm; **±2** = Solenoid valve activation; **±3** = Re-sync request; **±4** = Remote; **NOTE**: **"+"** indicates that the output is active if the contact is closed. **"-"** indicates that the output is active if the contact is open.	1681	---	R/W	SHORT	Y	---	-4...4
I03	**AI T** sensor type. **0** = Digital input; **1** = NTC probe; **6** = Pt1000 probe.	1682	---	R/W	BYTES	---	---	0...6
I04	**AI M** sensor type. **0** = Digital input; **1** = NTC probe; **6** = Pt1000 probe; **10** = Transducer 4...20 mA (0...10 barg); **11** = Transducer 4...20 mA (0...16 barg); **12** = Transducer 4...20 mA (0...30 barg); **13** = Transducer 4...20 mA (0...50 barg); **20** = Ratiometric transducer 0...5 V (0...7 barg); **21** = Ratiometric transducer 0...5 V (0...25 barg); **22** = Ratiometric transducer 0...5 V (0...60 barg); **30** = Custom transducer (probe_Scaling).	1683	---	R/W	BYTES	---	---	0...30
	CUSTOM INPUT CONFIGURATION group							
I05	**AI M** x-axis probe type. **0** = 0...20 mA; **1** = 4...20 mA; **2** = 0...5 V; **3** = 0...10 V; **4** = NTC.	1684	---	R/W	3 BIT	---	---	0...4
I06	Maximum **AI M** x-axis value.	1685	---	R/W	BYTES	---	---	0.00...20.00
I07	Minimum **AI M** x-axis value.	1686	---	R/W	BYTES	---	---	0.00...20.00
I08	Maximum **AI M** y-axis value.	1687	---	R/W	SHORT	Y	---	-32768...32767

Par.	Description	Val. Par. Adr.	Filter value	R/W	DATA SIZE	CPL	MU	Range
I09	Minimum **AI M** y-axis value.	1688	---	R/W	SHORT	Y	---	-327.68...327.67
I11	Remote **AI T** sensor type. **2** = NTC; **7** = Pt1000; **99** = Digital input.	1690	---	R/W	BYTES	---	-	2...99
I12	Remote **AI M** remote sensor type. **2** = NTC; **3** = 0...20 mA; **4** = 4...20 mA; **5** = 0...5 V; **6** = 0...10 V; **7** = Pt1000; **99** = Digital input.	1691	---	R/W	BYTES	---	-	2...99
	AI D remote sensor type. **2** = NTC; **7** = Pt1000; **99** = Digital input.	1692	---	R/W	BYTES	---	-	2...99
	SERIAL COMMUNICATION PORT CONFIGURATION group							
C01	Modbus serial address.	1728	---	R/W	BYTES	---	---	1...247
C02	Modbus parity. **0** = None; **1** = Odd; **2** = Even.	1729	---	R/W	2 BIT	---	---	0...2
C03	Modbus baud rate. **0** = 1200; **1** = 2400; **2** = 4800; **3** = 9600; **4** = 19200.	1730	---	R/W	3 BIT	---	---	0...4
C04	Modbus stop bits. **0** = 1 stop bit; **1** = 2 stop bits.	1731	---	R/W	1 BIT	---	---	0/1
C05	TTL serial address.	1732	---	R/W	BYTES	---	---	1...247
C06	TTL baud rate. **0** = 1200; **1** = 2400; **2** = 4800; **3** = 9600; **4** = 19200.	1733	---	R/W	2 BIT	---	---	0...4
C07	TTL parity. **0** = None; **1** = Odd; **2** = Even.	1734	---	R/W	3 BIT	---	---	0...2
C08	TTL stop bits. **0** = 1 stop bit; **1** = 2 stop bits.	1735	---	R/W	1 BIT	---	---	0/1
BLE	Epoca TTL usage.	1736	---	R/W	BYTES	---	---	0...247
C10	IB serial address. **0** = Node 7; **1** = Node 8.	1737	---	R/W	1 BIT	---	---	0/1
	PASSWORD group							
C14	User password.	1738	---	R/W	SHORT	Y	---	-32768...32767
C15	Maintenance password.	1739	---	R/W	SHORT	Y	---	-32768...32767
C16	Manufacturer password.	1740	---	R/W	SHORT	Y	---	-32768...32767

12.7.2 Modbus resource and status table

Code	Description	Val. Adr.	Vis. Par. Val. Adr.	R/W	DATA SIZE	CPL	MU	Range
S01	Control measurement value.	1281	4353	R	SHORT	---	---	-3276.8... 3276.7
S02	Intake temperature value.	1282	4354	R	SHORT	---	---	-3276.8... 3276.7
S03	Evaporation temperature value.	1283	4355	R	SHORT	---	---	-3276.8... 3276.7
S04	Evaporation pressure value.	1284	4356	R	SHORT	---	---	-3276.8... 3276.7
S05	Current EEV position.	1285	4357	R	BYTES	---	%	0.00 ... 100.00
S06	Alarm in progress. **0** = No alarm. **1** = Alarm in progress.	1286	4358	R	1 BIT	---	%	0/1
S07	Current machine status. **0** = Initialisation; **1** = Waiting for end of synchronisation; **2** = Waiting for end of positioning; **3** = Alarm; **10** = Standby; **30** = Positioner; **40** = Equalisation; **41** = Start-up; **50** = Manual; **60** = Algorithm.	1287	4359	R	WORD	---	%	0...65535
S08	EEV positioning setpoint.	1288	4360	R	WORD	---	%	0...32767
S09	EEV positioning setpoint in steps.	1289	4361	R	WORD	---	steps	0...32767
S10	Current EEV position in steps.	1290	4362	R	WORD	---	steps	0...32767
S11	Regulation setpoint.	1291	4363	R	SHORT	---	K/°C	-3276.8... 3276.7
S12	MOP correction value.	1292	4364	R	SHORT	---	K/R	-3276.8... 3276.7
S13	Minimum stable setpoint correction value.	1293	4365	R	SHORT	---	K/R	-3276.8... 3276.7
S14	PID control output value.	1294	4366	R	WORD	---	%	0...32767
S15	Algorithm status.	1295	4367	R	1 BIT	---	---	0/1
S16	Hours of unit operation.	1296	4368	R/W	WORD	---	---	0...32767
S17	Hours of EEV operation.	1297	4369	R/W	WORD	---	---	0...32767
S18	Valve parameter copy command in generic valve.	1298	4370	R/W	1 BIT	---	---	0/1
S19	Reset command. **0x0001** = Reset all; **0x0050** = Reboot request; **0x00B0** = StatusEVD Initialisation; **0x00C0** = StatusEVD Equalisation; **0x00D0** = AlgoInitReq = 1.	1299	4371	R/W	BYTES	---	---	0...208
S20	Valve enable.	1300	4372	R	1 BIT	Y	K/°C	0/1
S21	Enable command. **0** = Regulation algorithm disabled; **1** = Regulation algorithm enabled.	1301	4373	R/W	1 BIT	Y	K/°C	0/1
S22	Re-synchronisation command.	1302	4374	R/W	1 BIT	Y	K	0/1
S23	Remote control measurement value.	1303	4375	R/W	BYTES	Y	K	0...212
S24	Digital output command.	1304	4376	R/W	1 BIT	---	---	0/1
S25	Manual positioning setpoint.	1305	4377	R/W	BYTES	---	---	0...100
S26	Step rate value in debugger mode.	1306	4378	R/W	WORD	Y	---	0...1000
S27	Minimum position in debugger mode.	1307	4379	R/W	BYTES	Y	---	0...100
S28	Maximum position in debugger mode.	1309	4381	R/W	BYTES	---	%	0...100

Code	Description	Val. Adr.	Vis. Par. Val. Adr.	R/W	DATA SIZE	CPL	MU	Range
S29	Analogue input in use. **0** = No analogue input used. **1** = AI T; **2** = AI M; **3** = AI M and AI T; **4** = Digital input; **5** = AI T and Digital input; **6** = AI M; **7** = AI M; AI T and Digital input.	1310	4382	R	BYTES	---	%	0...7
S30	Remote **AI T** probe type.	1311	4383	R	SHORT	Y	°C	-3276.8... 3276.7
S31	Remote **AI M** probe type.	1312	4384	R	SHORT	Y	°C	-3276.8... 3276.7
ALARM STATUS								
AL01	Alarm: valve communication.		---	R	1 BIT	---	---	0/1
AL02	Alarm: valve high regulation temperature, HiSH.		---	R	1 BIT	---	---	0/1
AL03	Alarm: valve low regulation temperature, LoSH.		---	R	1 BIT	---	---	0/1
AL04	Alarm: valve high pressure, MOP.		---	R	1 BIT	---	---	0/1
AL05	Alarm: valve low pressure, LOP.		---	R	1 BIT	---	---	0/1
AL07	Alarm: **AI T** probe.		---	R	1 BIT	---	---	0/1
AL08	Alarm: **AI M** probe.		---	R	1 BIT	---	---	0/1
AL09	Alarm: valve motor.		---	R	1 BIT	---	---	0/1
AL10	Memory alarm.		---	R	1 BIT	---	---	0/1
AL11	Alarm: configuration.		---	R	1 BIT	---	---	0/1

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