Process controller with PROFIBUS DP and Modbus Master/Slave

1/8 DIN - 48 x 96

X5 line

User manual • M.I.U. X5 - 5/09.09 • Cod. J30-478-1AX51E

ASCON spa
ISO 9001 Certified

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Process controller with PROFIBUS DP and Modbus Master/Slave
1/8 DIN - 48 x 96
X5 line
Please, read carefully these instructions before proceeding with the installation of the controller.

Class II instrument, real panel mounting.

This controller has been designed with compliance to the European Directives. Consult Declaration of Conformity for further details on Directives and Standards used for Compliance. Declaration of Conformity of the controller can be found in the file: ASCON_DC_G2.zip downloadable from our web site: www.ascon.it

To download the file:
Select: Download/Documentation, and fill the table with:
- Typology: Manual
- Type: All
- Language: All
- Code: GAMMA2
Click: SEARCH and download the file: ASCON_DC_G2.zip.

The device has no user serviceable parts and requires special equipment and specialised engineers. Therefore, a repair can be hardly carried on directly by the user. For this purpose, the manufacturer provides technical assistance and the repair service for its Customers. Please, contact your nearest Agent for further information.

All the information and warnings about safety and electromagnetic compatibility are marked with the sign, at the side of the note.
TABLE OF CONTENTS

1 INTRODUCTION ................................................................. page 4
   1.1 PRODUCT CODING .................................................. page 5

2 INSTALLATION ................................................................. page 6
   2.1 DESCRIPTION ....................................................... page 6
   2.2 OPERATING CONDITIONS ....................................... page 8
   2.3 INSTALLATION ....................................................... page 9

3 ELECTRICAL CONNECTIONS .............................................. page 10
   3.1 TERMINATION UNIT ............................................... page 10
   3.2 CABLING LAYOUT .................................................. page 11
   3.3 EXAMPLE OF WIRING DIAGRAM ............................... page 12

4 OPERATIONS ................................................................. page 22
   4.1 KEYS FUNCTIONS AND DISPLAY ............................. page 22
   4.2 DATA SETTING ....................................................... page 24
   4.3 CONFIGURATION ..................................................... page 25
   4.4 PARAMETERISATION ............................................. page 34
   4.5 PARAMETERS ........................................................ page 42
   4.6 ACCESS LEVELS ...................................................... page 50

5 DISPLAYS ............................................................................. page 53

6 COMMANDS ........................................................................ page 54
   6.1 COMMANDS FROM KEYBOARD ................................ page 55
   6.2 COMMANDS FROM DIGITAL INPUTS ....................... page 58
   6.3 COMMANDS FROM SERIAL COMMUNICATION ... page 58
       (PLEASE, REFER THE ADDENDUM ON THE SERIAL COMMUNICATION)

7 SETPOINT PROGRAMMER (OPTIONAL) .............................. page 59
   7.1 PROGRAM ORGANISATION ................................... page 59
   7.2 OPERATING CONDITIONS ...................................... page 60
   7.3 PARAMETERISATION - PROGRAM MENU ............... page 62
   7.4 PROGRAM STATUS DISPLAYING ............................. page 64
   7.5 RUN/STOP OF A PROGRAM ..................................... page 65

8 TECHNICAL SPECIFICATIONS ........................................... page 69
1 - Introduction

1 INTRODUCTION

POWERFUL FEATURES AND A WIDE RANGE OF FUNCTIONALITIES

Congratulations for having chosen these universal controllers. They are the best result of our experience in designing and manufacturing of smart, powerful and high reliable controllers.

The process controllers of the X5 series have been designed for the industrial environment, are provided with a complete set of functions, as a true universal instrument.

They can be used as Controllers-Programmers with 4 Setpoint profiles of 16 segments.
1.1 MODEL CODE

The complete code is displayed on the instrument label. The information about product coding are accessible from the front panel by mean of a particular procedure described at section 5.1 page 53.

Note: [1] Not available with split range control mode

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**Instrument label**

P/N : X5-3150-0000
CONF : A0A-9919/0013
V-(L-N) : 100-240V 50/60 Hz - 5W
Installation must only be carried out by qualified personnel.

Before proceeding with the installation of this controller, follow the instructions illustrated in this manual and, particularly the installation precautions marked with the symbol, related to the European Community directive on electrical protection and electromagnetic compatibility.

To prevent hands or metal touching parts that may be electrically live, the controllers must be installed in an enclosure and/or in a cubicle.
2.1.1 DIMENSIONAL DETAILS

- 96 mm (3.78 in)
- 110 mm (4.33 in)
- 48 mm (1.89 in)
- 10 mm max. (0.39 in max.)

2.1.2 PANEL CUT-OUT

- 65 mm min (2.56 in min)
- 45+0.6 mm (1.78+0.023 in)
- 113 mm min (4.45 in min)
## 2.2 ENVIRONMENTAL RATINGS

### Operating conditions

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Condition</th>
<th>Suggestions</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Altitude" /></td>
<td>Altitude up to 2000 m</td>
<td></td>
</tr>
<tr>
<td><img src="image" alt="Temperature" /></td>
<td>Temperature 0…50°C [1]</td>
<td></td>
</tr>
<tr>
<td><img src="image" alt="Relative humidity" /></td>
<td>Relative humidity 5…95 % non-condensing</td>
<td></td>
</tr>
</tbody>
</table>

### Special conditions

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Condition</th>
<th>Suggestions</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Altitude" /></td>
<td>Altitude &gt; 2000 m</td>
<td>Use 24Vac supply version</td>
</tr>
<tr>
<td><img src="image" alt="Temperature" /></td>
<td>Temperature &gt; 50°C</td>
<td>Use forced air ventilation</td>
</tr>
<tr>
<td><img src="image" alt="Relative humidity" /></td>
<td>Humidity &gt; 95 %</td>
<td>Warm up</td>
</tr>
<tr>
<td><img src="image" alt="Conducting atmosphere" /></td>
<td>Conducting atmosphere</td>
<td>Use filter</td>
</tr>
</tbody>
</table>

### Forbidden Conditions

- Corrosive atmosphere
- Explosive atmosphere

**UL notes**

[1] Operating surrounding temperature 0…50°C
2.3 PANEL MOUNTING [1]

2.3.1 INSERT THE INSTRUMENT

1. Prepare panel cut-out;
2. Check front panel gasket position;
3. Insert the instrument through the cut-out.

2.3.2 INSTALLATION SECURING

1. Fit the mounting clamps;
2. Push the mounting clamps towards the panel surface to secure the instrument.

2.3.3 CLAMPS REMOVING

1. Insert the screwdriver in the clips of the clamps;
2. Rotate the screwdriver.

2.3.4 INSTRUMENT UNPLUGGING

1. Push and
2. Pull to remove the instrument.

Electrostatic discharges can damage the instrument.

Before removing the instrument the operator must discharge himself to ground.

UL note

[1] For Use on a Flat Surface of a Type 2 and Type 3 'raintight' Enclosure.
3 - Electrical Connections

3.1 TERMINAL BLOCK [1]

UL notes
[1] Use 60/70 °C copper (Cu) conductor only.
[2] Wire size 1 mm² (18 AWG Solid/Stranded)

Terminal Block

- 35 screw terminals M3
- Option terminals
- Holding screw 0.5 Nm
- Positive screw-driver PH1
- Negative screw-driver 0.8 x 4 mm

- Pin connector Φ 1.4 mm - 0.055 in max.
- Fork-shape AMP 165004 Ø 5.5 mm - 0.21 in
- Stripped wire L 5.5 mm - 0.21 in

- Cable size 1 mm² [2]

- Rear terminal cover

- Use 60/70 °C copper (Cu) conductor only.
- Wire size 1 mm² (18 AWG Solid/Stranded)
PRECAUTIONS

Despite the fact that the instrument has been designed to work in a harsh and noisy environmental (level IV of the industrial standard IEC 801-4), it is recommended to follow the following suggestions.

⚠️ All the wiring must comply with the local regulations.
The supply wiring should be routed away from the power cables. Avoid to use electromagnetic contactors, power Relays and high power motors nearby. Avoid power units nearby, especially if controlled in phase angle.

Keep the low level sensor input wires away from the power lines and the output cables. If this is not achievable, use shielded cables on the sensor input, with the shield connected to earth.

3.2 SUGGESTED WIRES ROUTING

Conduit for supply and output cables

Conduit for low level sensor cables

A = Supply
B = Outputs
C = Analog inputs
D = Analogue output
E = Digital input
Serial Comm.s
3 - Electrical Connections

3.3 EXAMPLE OF WIRING DIAGRAM (VALVE CONTROL)

Notes:
1) Make sure that the power supply voltage is the same indicated on the instrument.
2) Switch on the power supply only after that all the electrical connections have been completed.
3) In accordance with the safety regulations, the power supply switch shall bring the identification of the relevant instrument. The power supply switch shall be easily accessible from the operator.
4) The instrument is PTC protected. In case of failure it is suggested to return the instrument to the manufacturer for repair.
5) To protect the instrument internal circuits use:
   - 2 AT fuse for Relay outputs (220 Vac)
   - 4 AT fuse for Relay outputs (110 Vac)
   - 1 AT fuse for Triac outputs
6) Relay contacts are already protected with varistors.
   Only in case of 24 Vac inductive loads, use model A51-065-30D7 varistors (on request)
3.3.1 POWER SUPPLY
Switching power supply with multiple isolation and PTC protection.

- **Standard version:**
  Nominal voltage: 100...240Vac (-15...+10%);
  Frequency 50/60Hz.

- **Low Voltage version:**
  Nominal voltage: 24Vac (-25...+12%);
  Frequency 50/60Hz or 24Vdc (-15...+25%);
  Power consumption 5W max.

A L-J-K-S-R-T-B-N-E-W thermocouple type
- Connect the wires with the polarity as shown;
- Use always compensation cable of the correct type for the thermocouple used;
- The shield, if present, must be connected to a proper earth.

B For Pt100 resistance thermometer
- If a 3 wires system is used, use always cables of the same diameter (1mm² min.), maximum line resistance 20 Ω/line.
- When using a 2 wires system, use always cables of the same section (1.5mm² min.) and put a jumper between terminals 11 and 12

C For ΔT (2x RTD Pt100) Special
- When the distance between the controller and the sensor is 15m using a cable of 1.5mm² section, produces an error on the measure of 1°C.
- R1 + R2 must be <320Ω
3 - Electrical Connections

### 3.3.2 PV CONTROL INPUT

**C** For mA, mV

Input resistance = 30Ω per mA;
Input resistance > 10MΩ per mV;
Input resistance = 10kΩ per Volt;

**C1 With 2 wires transducer**

Using the frequency input (IN2), the IN1 input is not yet available

- Low level: 0...2Volts / 0.5mA max.
- High level: 3...24Volts / ~ 0 mA max.
- Frequency range: 0...2kHz / 0...20kHz, selectable in configuration mode;
- Use sensors with an NPN output or a clean contact.

**C2 With 3 wires transducer**

[1] Auxiliary power supply for external transmitter 24Vdc ±20%/30mA max without short circuit protection.
3.3.4 AUXILIARY INPUT

A - From Remote Setpoint

Current 0/4...20mA; Input resistance = 30Ω.

Voltage 1...5V, 0...5V, 0...10V; Input resistance = 300kΩ.

Not available with frequency input

B - From Potentiometer

for the measure of the position of the motor or the valve.

100% Operating travel
Pot.
Pot.
Total travel

Distance

3.3.5 DIGITAL INPUT

• The input is active when the logic state is ON, corresponding to the contact closed.

• The input is inactive when the logic state is OFF, corresponding to the contact open.

TTL  o.c.  NPN  o.c.  Isolated contact

Com.  + IL 1  + IL 2  + IL 3
### 3.3.6 OP1 - OP2 - OP3 - OP4 - OP5 - OP6 OUTPUTS (OPTION)

The functionality associated to each of the OP1, OP2, OP4, OP5 and OP6 output is defined during the configuration of the instrument. The suggested combinations are:

<table>
<thead>
<tr>
<th>Control outputs</th>
<th>Main (Heat)</th>
<th>Secondary (Cool)</th>
<th>Alarms</th>
<th>Alarms</th>
<th>Alarms</th>
<th>PV / SP / OP</th>
</tr>
</thead>
<tbody>
<tr>
<td>OP1</td>
<td>OP1</td>
<td>OP2</td>
<td>OP3</td>
<td>OP4</td>
<td>OP5</td>
<td>OP6</td>
</tr>
<tr>
<td>OP5</td>
<td>OP5</td>
<td>OP1</td>
<td>OP2</td>
<td>OP3</td>
<td>OP4</td>
<td></td>
</tr>
<tr>
<td>Split range</td>
<td>OP5</td>
<td>OP6</td>
<td>OP1</td>
<td>OP2</td>
<td>OP3</td>
<td>OP4</td>
</tr>
<tr>
<td>OP1</td>
<td>OP1</td>
<td>OP2</td>
<td>OP3</td>
<td>OP4</td>
<td>OP5</td>
<td>OP6</td>
</tr>
<tr>
<td>OP5</td>
<td>OP5</td>
<td>OP2</td>
<td>OP1</td>
<td>OP3</td>
<td>OP4</td>
<td>OP6</td>
</tr>
<tr>
<td>Double action</td>
<td>OP5</td>
<td>OP6</td>
<td>OP2</td>
<td>OP3</td>
<td>OP4</td>
<td></td>
</tr>
<tr>
<td>Valve drive</td>
<td>OP1 ▲</td>
<td>OP2 ▼</td>
<td>OP3</td>
<td>OP4</td>
<td>OP5</td>
<td>OP6</td>
</tr>
</tbody>
</table>

where:

- **OP1 - OP2**: Relay or Triac output
- **OP3 - OP4**: Relay outputs
- **OP5 - OP6**: Analogue/digital control or retransmission outputs
### 3.3.6-A SINGLE ACTION RELAY (TRIAC) CONTROL OUTPUT

- **Fuse**
- **Coil of the heat load contactor**

### 3.3.6-B1 SINGLE ACTION SSR DRIVE CONTROL OUTPUT

- **Static Relay**
- **Heat load**

### 3.3.6-B2 SINGLE ACTION ANALOGUE OUTPUT

- **Heat load**

### 3.3.6-C DOUBLE ACTION RELAY (TRIAC)/RELAY (TRIAC) CONTROL OUTPUT

- **Fuse**
- **Coil of the heat load contactor**

### 3.3.6-D1 DOUBLE ACTION RELAY (TRIAC)/SSR DRIVE CONTROL OUTPUT

- **Fuse**
- **Coil of the heat load contactor**

### 3.3.6-D2 DOUBLE ACTION CONTROL OUTPUT RELAY (TRIAC)/ANALOGUE CONTROL OUTPUT

- **Fuse**
- **Coil of the cool load contactor**

---

**x5-uk-ed5  17-09-2009  14:53  Pagina 17**
3 - Electrical Connections

### 3.3.6-E1 DOUBLE ACTION
**DIGITAL/RELAY (TRIAC) CONTROL OUTPUT**

- Static Relay
- Heat load

#### Notes for pages 17 - 18 - 19
- **OP1 - OP2 Relay output**
  - SPST Relay N.O., 2A/250 Vac (4A/120Vac) for resistive load,
  - Fuse 2AT at 250V, 4AT at 110V.

- **OP1 - OP2 Triac output**
  - N.O. contact for resistive load of up to 1A/250 Vac max.
  - Fuse 1AT

- **Isolated digital outputs OP5-OP6**
  - 0…24Vdc, ±20%, 30 mA max.

- **Isolated analogue outputs OP5-OP6**
  - 0/4…20mA, 750Ω / 15V max.
  - 0/1…5V, 0…10V, 500Ω / 20mA max.

- **[1] Varistor for inductive load 24Vac only**
3.3.6-F2  DOUBLE ACTION CONTROL OUTPUT
DIGITAL / ANALOGUE

3.3.6-F3 DOUBLE ACTION CONTROL OUTPUT
ANALOGUE / DIGITAL

3.3.6-F4 DOUBLE ACTION CONTROL OUTPUT OR SPLIT RANGE
ANALOGUE / ANALOGUE

3.3.6-G  MOTOR POSITIONER OUTPUT
RELAY (TRIAC)/RELAY (TRIAC)
Valve drive PID without potentiometer
3 pole output with N.O. contacts
(increase, decrease, stop)

x5-uk-ed5  17-09-2009  14:53  Pagina 19
3 - Electrical Connections

3.3.7 OP1-2-3-4 ALARM OUTPUTS

The relay/triac output OP1, OP2, can be used as alarm outputs only if they are not used as control outputs.

3.3.8 OP5 AND OP6 (OPTION) ANALOGUE CONTROL OUTPUTS

OP5 and OP6 outputs can be configured for control action or PV/SP/OP retransmission:
- Galvanic isolation 500Vac/1 min;
- 0/4…20mA, 750Ω / 15Vdc max.
- 0/1…5V, 0…10V, 500Ω / 20mA max.

Notes:
[1] Varistor for inductive load 24Vac only
[2] Please, read the user manual: “gamma due® and delta due® controller series serial communication and configuration software”.

3.3.9 SERIAL COMMUNICATIONS (OPTION) [2]

- Galvanic isolation 500Vac/1 min;
- Compliance to the EIA RS485 standard for Modbus/Jbus;
- Termination setting dip switches.
3.3.10 PROFIBUS DP (OPTION)

Termination resistors 220Ω and 390Ω (1/4 W, ±5%) for external mounting on the initial and ending PROFIBUS stations only.

- Galvanic isolation 500 Vac/1 min
- Compliance to the EIA RS485 standard for PROFIBUS DP;
- Connecting cable: twisted pair cable as per PROFIBUS specifications (e.g. Belden B3079A);
- Max. length: 100 m at 12 Mb/s

To make the connections easier, a D-Sub type (9 poles) connector: model AP-ADP-PRESA-DSUB/9P
Must be used with a 9PIN male ERNI type part no. 103648 or similar connector.

---

<table>
<thead>
<tr>
<th>X5</th>
<th>D-SUB 9 poles</th>
<th>Signal</th>
<th>Description according to PROFIBUS specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3</td>
<td>RxD/TxD-P (DP)</td>
<td>Receive data/transmission data plus</td>
</tr>
<tr>
<td>2</td>
<td>8</td>
<td>RxD/TxD-N (DN)</td>
<td>Receive data/transmission data negative</td>
</tr>
<tr>
<td>3</td>
<td>5</td>
<td>DGND (DG)</td>
<td>Data transmission potential (ground to 5V)</td>
</tr>
<tr>
<td>4</td>
<td>6</td>
<td>VP (VP)</td>
<td>Supply voltage of the terminating resistance-P. (PSV)</td>
</tr>
</tbody>
</table>

Detailed information concerning wiring and cables can be found on the PROFIBUS Product Guide or on Internet at:
http://www.profibus.com/online/list
4 - Operation

**OPERATION**

### 4.1.1 KEY FUNCTIONS AND DISPLAYS IN OPERATOR MODE

**Digital input status LEDs (yellows)**
- \( \square \): IL1 active
- \( \bigcirc \): IL2 active
- \( \bigodot \): IL3 active

**Status LEDs (greens)**
- \( \text{LED} \): Communications running
- \( \text{AT} \): Tuning running
- \( \text{MAN} \): Manual operating mode
- \( \text{RUN} \): Timer/Program running
- \( \text{HLD} \): Program Waiting
- \( \text{REM} \): Remote Setpoint active
- \( S_1 \): First stored Setpoint active
- \( S_2 \): Second stored Setpoint active
- \( S_3 \): Third stored Setpoint active

**Alarm status LEDs (reds)**
- \( \text{AL1 ON} \)
- \( \text{AL2 ON} \)
- \( \text{AL3 ON} \)
- \( \text{AL4 ON} \)

**Auto/Man**

**PV control input in engineering units**

<table>
<thead>
<tr>
<th>Over range</th>
<th>Under range</th>
</tr>
</thead>
<tbody>
<tr>
<td>( 45.80 )</td>
<td>( 50 )</td>
</tr>
</tbody>
</table>

**Control output LEDs (red)**
- \( \text{OP1/OP4 ON - OP2/OP4 OFF} \)

**Run/stop Timer or a program**

<table>
<thead>
<tr>
<th>( \text{Sp operating Setpoint} )</th>
<th>( \text{Setpoint setting} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \text{SP operating Setpoint} )</td>
<td>( \text{Setpoint setting} )</td>
</tr>
</tbody>
</table>

**Entry key for selection and value setting confirmation**

**Menu access**
4.1.2 KEYS FUNCTIONS AND DISPLAY IN PROGRAMMING MODE

The parameter setting procedure has a timeout. If no keys are pressed for at least 30 seconds, the controller switches back, automatically, to the operator mode.

After having selected the parameter or the code, press \( \text{ } \) and \( \text{ } \) to display or modify the value.

The value is entered when the next parameter is selected, by pressing the \( \text{ } \) key. Pressing the back key \( \text{ } \) or after 30 seconds from the last modification, the value doesn’t change.

From every parameter, pressing the \( \text{ } \) key, the controller switches to the operator mode.
4 - Operation

4.2 PARAMETER SETTING

4.2.1 NUMERIC ENTRY

(i.e. the modification of the Setpoint value from 275.0 to 240.0)

Press \(\downarrow\) or \(\uparrow\) momentarily to change the value of 1 unit every push.
Continued pressing of \(\downarrow\) or \(\uparrow\) changes the value, at a rate that doubles every second.
Releasing the button the rate of change decreases.
In any case the change of the value stops when it has reached the max/min. limit set for the parameter.

In case of Setpoint modification: press \(\downarrow\) or \(\uparrow\) once to display the local Setpoint instead of working Setpoint.
To evidence this change the display flashes once. Then the Setpoint can be modified.

4.2.2 MNEMONIC CODES SETTING

(e.g. configuration see page 26)

Press the \(\downarrow\) or \(\uparrow\) to display the next or previous mnemonic for the selected parameter.
Continued pressing of \(\downarrow\) or \(\uparrow\) will display further mnemonics at a rate of one mnemonic every 0.5 s. The mnemonic displayed at the time the next parameter is selected, is the one stored in the parameter.

Press the \(\downarrow\) or \(\uparrow\) to display the next or previous mnemonic for the selected parameter.
Continued pressing of \(\downarrow\) or \(\uparrow\) will display further mnemonics at a rate of one mnemonic every 0.5 s. The mnemonic displayed at the time the next parameter is selected, is the one stored in the parameter.
4.3 CONFIGURATION PROCEDURE

- Enter the configuration password (from -999.9999, 33 default from factory)
- Must be equal to the value of the parameter CPAS (see page 50)

1. Press the key until
2. Select the configuration menu
3. Enter the configuration password
4. OK
5. Yes
6. NO
7. Back to the operator mode

- Inputs Configuration
- Setpoint Configuration
- Output Configuration
- Digital inputs configuration
- Alarm s configuration
- Output Configuration

(see page 26) (see page 27) (see pages 28 e 29) (see page 30) (see page 31)
## 4.3.1 INPUTS CONFIGURATION

### Linear Input Only

<table>
<thead>
<tr>
<th>Input type</th>
<th>Value</th>
<th>Description</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>tc. j</td>
<td>0...600°C</td>
<td>32...1112°F</td>
<td>°C</td>
</tr>
<tr>
<td>tc. l</td>
<td>32...1112°F</td>
<td>32...1112°F</td>
<td>°F</td>
</tr>
<tr>
<td>tc. k</td>
<td>0...20 mA</td>
<td>32...20 Hz</td>
<td>mA</td>
</tr>
<tr>
<td>tc. s</td>
<td>0...10 Volt</td>
<td>32...20 Hz</td>
<td>mV</td>
</tr>
<tr>
<td>tc. b</td>
<td>0...1800°C</td>
<td>32...20 Hz</td>
<td>°C</td>
</tr>
<tr>
<td>tc. E</td>
<td>0...600°C</td>
<td>32...20 Hz</td>
<td>°C</td>
</tr>
<tr>
<td>Fr. L</td>
<td>0...2.000 Hz</td>
<td>32...20 Hz</td>
<td>Hz</td>
</tr>
<tr>
<td>Fr. N</td>
<td>0...20.000 Hz</td>
<td>32...20 Hz</td>
<td>Hz</td>
</tr>
</tbody>
</table>

### Engineering Unit

- None
- °C
- °F
- mV
- Volt
- bar
- PSI
- °R
- °H
- °P
- °M
- Hz

### Notes:

1. NiChroSi-NiSil thermocouple.
2. Ni-Mo thermocouple.
4.3.2 SETPOINT CONFIGURATION

Setpoint type see table 3
Stored Setpoint Tracking see page 43
Setpoint slope time units PSec/Min/Hr
REMOTE INPUT ONLY

Remote Setpoint input see table 4 not displayed if the frequency input is present
Remote Setpoint Slope enable [1] no/yes

[1] Not available with Setpoint Programmer option

Tab. 3 Setpoint type
<table>
<thead>
<tr>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loc</td>
<td>Local only</td>
</tr>
<tr>
<td>rErr</td>
<td>Remote only</td>
</tr>
<tr>
<td>Loc/Er</td>
<td>Local/remote only</td>
</tr>
<tr>
<td>Loc</td>
<td>Local - trim</td>
</tr>
<tr>
<td>rErr</td>
<td>Remote - trim</td>
</tr>
<tr>
<td>PrO</td>
<td>Programmed (option)</td>
</tr>
</tbody>
</table>

Tab. 4 Rem. Setpoint r.5 In
<table>
<thead>
<tr>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-5</td>
<td>0…5 Volt</td>
</tr>
<tr>
<td>1-5</td>
<td>1…5 Volt</td>
</tr>
<tr>
<td>0-10</td>
<td>0…10 Volt</td>
</tr>
<tr>
<td>0-20</td>
<td>0…20 mA</td>
</tr>
<tr>
<td>1-20</td>
<td>1…20 mA</td>
</tr>
</tbody>
</table>

Tab. 4 Rem. Setpoint [r.5] In
<table>
<thead>
<tr>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-5</td>
<td>0…5 Volt</td>
</tr>
<tr>
<td>1-5</td>
<td>1…5 Volt</td>
</tr>
<tr>
<td>0-10</td>
<td>0…10 Volt</td>
</tr>
<tr>
<td>0-20</td>
<td>0…20 mA</td>
</tr>
<tr>
<td>1-20</td>
<td>1…20 mA</td>
</tr>
</tbody>
</table>
4.3.3 OUTPUT CONFIGURATION

[1] Not available with Setpoint Programmer option (S.P.ty = Pr Seq.)
When OP5 and OP6 outputs are not configured as control output, they can retransmit the PV, SP or OP linearised value.

**Retransmission**

**Retransmitted signals**

<table>
<thead>
<tr>
<th>Retransmission high range</th>
<th>Retransmission low range</th>
</tr>
</thead>
<tbody>
<tr>
<td>[ r_t.H ]</td>
<td>[ r_t.L ]</td>
</tr>
</tbody>
</table>

**Example:**
- T/C S: range 0...1600°C;
- Output range, 4...20 mA;
- Retransmitted signal PV on 800...1200°C range.

**Output range**

\[
\begin{align*}
\text{Main output} & : r_t.H \ 0 \cdot 5/1 \cdot 5 / 0 \cdot 10 \\
\text{Secondary output} & : r_t.2 \ 0 \cdot 20 / 4 \cdot 20 \\
\end{align*}
\]

The following parameters define the low and high range.

**With** \[ r_t.L \] **greater than** \[ r_t.H \], it is possible to obtain a reverse scale.

---

**Tab. 6 Main Output (Heat)**

<table>
<thead>
<tr>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>OFF</td>
<td>Not used</td>
</tr>
<tr>
<td>OP 1</td>
<td>Relay / Triac</td>
</tr>
<tr>
<td>La 2</td>
<td>Digital</td>
</tr>
<tr>
<td>0-5</td>
<td>0...5 Volt</td>
</tr>
<tr>
<td>1-5</td>
<td>1...5 Volt</td>
</tr>
<tr>
<td>0-10</td>
<td>0...10 Volt</td>
</tr>
<tr>
<td>0-20</td>
<td>0...20 mA</td>
</tr>
<tr>
<td>4-20</td>
<td>4...20 mA</td>
</tr>
</tbody>
</table>

**Tab. 7 Secondary output (Cool)**

<table>
<thead>
<tr>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>OFF</td>
<td>Not used</td>
</tr>
<tr>
<td>OP 2</td>
<td>Relay / Triac</td>
</tr>
<tr>
<td>La 2</td>
<td>Digital</td>
</tr>
<tr>
<td>0-5</td>
<td>0...5 Volt</td>
</tr>
<tr>
<td>1-5</td>
<td>1...5 Volt</td>
</tr>
<tr>
<td>0-10</td>
<td>0...10 Volt</td>
</tr>
<tr>
<td>0-20</td>
<td>0...20 mA</td>
</tr>
<tr>
<td>4-20</td>
<td>4...20 mA</td>
</tr>
</tbody>
</table>

**Tab. 8 Retransmission outputs**

<table>
<thead>
<tr>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>[ r_t.L 1 ]</td>
<td>Output range</td>
</tr>
<tr>
<td>[ r_t.L 2 ]</td>
<td>Split range</td>
</tr>
</tbody>
</table>

**[1]** Not available with:
Setpoint Programmer option
(S.P.\% = P\% α 9)
4 - Operation

4.3.4 DIGITAL INPUTS CONFIGURATION

Tab. 10 - Digital Inputs Functions

<table>
<thead>
<tr>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>OFF</td>
<td>Not used</td>
</tr>
<tr>
<td>L-r</td>
<td>Local/Remote</td>
</tr>
<tr>
<td>M10n</td>
<td>Auto/Man</td>
</tr>
<tr>
<td>Sp.1</td>
<td>1° stored Setpoint</td>
</tr>
<tr>
<td>Sp.2</td>
<td>2° stored Setpoint</td>
</tr>
<tr>
<td>Sp.3</td>
<td>3° stored Setpoint</td>
</tr>
<tr>
<td>Lb.1</td>
<td>Keyboard lock</td>
</tr>
<tr>
<td>Lo.1</td>
<td>1° slope disable</td>
</tr>
<tr>
<td>Hpu</td>
<td>Measure hold</td>
</tr>
<tr>
<td>FOut</td>
<td>Output forcing mode</td>
</tr>
<tr>
<td>Prg.1</td>
<td>1° program</td>
</tr>
<tr>
<td>Prg.2</td>
<td>2° program</td>
</tr>
<tr>
<td>Prg.3</td>
<td>3° program</td>
</tr>
<tr>
<td>Prg.4</td>
<td>4° program</td>
</tr>
<tr>
<td>Sp.3</td>
<td>3° stored Setpoint</td>
</tr>
<tr>
<td>Sp.2</td>
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<tr>
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<tr>
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<tr>
<td>FOut</td>
<td>Output forcing mode</td>
</tr>
<tr>
<td>Prg.1</td>
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<tr>
<td>Prg.2</td>
<td>2° program</td>
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<tr>
<td>Prg.3</td>
<td>3° program</td>
</tr>
<tr>
<td>Prg.4</td>
<td>4° program</td>
</tr>
<tr>
<td>Sp.3</td>
<td>3° stored Setpoint</td>
</tr>
<tr>
<td>Sp.2</td>
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<tr>
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<td>Output forcing mode</td>
</tr>
<tr>
<td>Prg.1</td>
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<td>2° program</td>
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<tr>
<td>Prg.3</td>
<td>3° program</td>
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<tr>
<td>Prg.4</td>
<td>4° program</td>
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<tr>
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<td>Lb.1</td>
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</tr>
<tr>
<td>Lo.1</td>
<td>1° slope disable</td>
</tr>
<tr>
<td>Hpu</td>
<td>Measure hold</td>
</tr>
<tr>
<td>FOut</td>
<td>Output forcing mode</td>
</tr>
<tr>
<td>Prg.1</td>
<td>1° program</td>
</tr>
</tbody>
</table>
4 - Operation

**Tab. 11** Alarm type

<table>
<thead>
<tr>
<th>Value</th>
<th>Description</th>
<th>AL 1</th>
<th>AL 2</th>
<th>AL 3</th>
<th>AL 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>OFF</td>
<td>Not used or used by the program (AL3/AL4)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FSH</td>
<td>Active High Absolute (input)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FSL</td>
<td>Active Low</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>dPH</td>
<td>Active High Deviation (input)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>dPL</td>
<td>Active Low</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>bnd</td>
<td>Active In</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>bndo</td>
<td>Active Out</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OPH</td>
<td>Active High</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OPL</td>
<td>Active Low</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lba</td>
<td>Loop break alarm (AL1 only)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Note:**

*OPH, OPL absolute alarm on output value (full scale) can be associated only to AL2, AL3 and AL4.*
4 - Operation

4.3.6 AL1, AL2, AL3, AL4 ALARMS CONFIGURATION

It is possible to configure up to 4 alarms: AL1, AL2, AL3, AL4 (see page 31) selecting, for each of them:

A the type and the operating condition of the alarm (table 11 page 31)
B the functionality of the alarm acknowledge (latching)
C the start-up disabling (blocking)
D alarm inhibition on sensor break
E the physical output of the alarm

The outputs can be used for alarms if they are not used as control outputs

(see par. 3.3.7 page 20)

It is possible to route up to 4 alarm to a single output (OR of the alarms).

Alarm occurrence display
This function can be enabled by the configuration software.
Please, read the user manual: “gamma due® and delta due® controller series serial communication and configuration software”.

The type of alarm is presented flashing, on the front panel in alternation with the PV value.

The red led of the activated alarm output is on.

A] OPERATING CONDITIONS

<table>
<thead>
<tr>
<th>Alarm type</th>
<th>Action low</th>
<th>Action medium</th>
<th>Action high</th>
</tr>
</thead>
<tbody>
<tr>
<td>Absolute alarm</td>
<td>On</td>
<td>hyd</td>
<td>215.0</td>
</tr>
<tr>
<td>Deviation alarm</td>
<td>On</td>
<td>hyd</td>
<td>Off</td>
</tr>
<tr>
<td>Band alarm</td>
<td>On</td>
<td>hyd</td>
<td>Off</td>
</tr>
</tbody>
</table>

B] ALARM ACKNOWLEDGE FUNCTION

The alarm, once occurred, is presented on the display until the time of acknowledge. The acknowledge operation consists in pressing any key.

After this operation, the alarm leaves the alarm state only when the alarm condition is no longer present.
4 - Operation

[+] START-UP DISABLING

For those alarm that are configured to be different than LBA, is possible to set the parameter \(\text{donb} \) (disable on break).

Set:
- \(\text{no} \) To maintain the alarm status when a sensor break is detected.
- \(\text{yes} \) To disable the alarm intervention when a sensor break is detected. Once the sensor has been changed, the alarms that were active before the sensor break are activated again.

[ ] LOOP BREAK ALARM LBA

When the controller connection to the sensor is discontinued or other faults are detected in the control loop, the AL1 alarm becomes active, after a predefined time of 1…9999 s, from the detection of the failure (see page 37). When a sensor failure occurs, the LBA intervention is immediate. The alarm state ceases when the fault condition is no longer present.

[D] ALARM DISABLING AT SENSOR BREAK

In case of ON-OFF control, the LBA alarm is not active.
4.4 PARAMETERISATION - MAIN MENU

The parameter setting procedure has a timeout. If no keys are pressed for, at least, 30 seconds, the controller switches back automatically, to the operator mode.

The parameter setting procedure has a timeout. If no keys are pressed for, at least, 30 seconds, the controller switches back automatically, to the operator mode.
After having selected the parameter or the code, press $ or % to modify the value (see page 24) The value is entered when the next parameter is selected, by pressing the $ key.

Pressing % go back to the Operator mode
4.4.1 PARAMETERISATION - SETPOINT MENU

Depending on the configuration index shown on page 27, the following parameters are present or not.

[1] The units of the slope parameters are digit/s, digit/min digit/h

Setpoint menu

Setpoint selection local/remote

LOCAL/REMOTE, REMOTE OR PROGRAMMED INDEX

LOCAL WITH TRIM OR REMOTE WITH TRIM INDEX

Stored Setpoint selection none / S.LOC / S.SP1 / S.SP2 / S.SP3

1st stored Setpoint full scale

2nd stored Setpoint full scale

3rd stored Setpoint full scale

Ratio Setpoint -9.99...99.99

Remote Setpoint bias full scale

Setpoint low limit full scale

Setpoint high limit full scale

Remote enable ON

Slope up OFF...9999 digit

Slope down OFF...9999 digit

Slope setpoint remote enable OFF/on
### 4.4.2 PARAMETERISATION - ALARMS MENU

#### Alarms menu

<table>
<thead>
<tr>
<th>Alarm</th>
<th>Type and adj. value</th>
<th>Mode</th>
<th>Number and Parameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Absolute full scale on input</td>
<td>Active high</td>
<td>AL2...F000</td>
</tr>
<tr>
<td>2</td>
<td>Deviation full scale on input</td>
<td>Active high</td>
<td>AL3...D000</td>
</tr>
<tr>
<td>3</td>
<td>Band full scale on input</td>
<td>Active high</td>
<td>AL4...B000</td>
</tr>
<tr>
<td>4</td>
<td>Absolute full scale on output</td>
<td>Active high</td>
<td>AL5...O00</td>
</tr>
</tbody>
</table>

#### Alarm threshold values

- **Alarm threshold 1**
  - Active high: AL1...
  - Active low: AL1...

- **Alarm threshold 2**
  - Active high: AL2...
  - Active low: AL2...

- **Alarm threshold 3**
  - Active high: AL3...
  - Active low: AL3...

- **Alarm threshold 4**
  - Active high: AL4...
  - Active low: AL4...

#### Alarm hysteresis

- **Alarm 1 hysteresis asymmetric upper**
  - 0...5% Span in engineering units

- **Alarm 1 hysteresis asymmetric lower**
  - 0...5% Span in engineering units

- **Alarm 2 hysteresis asymmetric upper**
  - 0...5% Span in engineering units

- **Alarm 2 hysteresis asymmetric lower**
  - 0...5% Span in engineering units

- **Alarm 3 hysteresis asymmetric upper**
  - 0...5% Span in engineering units

- **Alarm 3 hysteresis asymmetric lower**
  - 0...5% Span in engineering units

- **Alarm 4 hysteresis asymmetric upper**
  - 0...5% Span in engineering units

- **Alarm 4 hysteresis asymmetric lower**
  - 0...5% Span in engineering units

#### Alarm delay

- **Alarm 1 delay**
  - OFF / 1...9999

- **Alarm 2 delay**
  - OFF / 1...9999

- **Alarm 3 delay**
  - OFF / 1...9999

- **Alarm 4 delay**
  - OFF / 1...9999

#### Note:

- A code, specifying the number and the alarm type that has been configured (see page 31), is displayed. At this point, the user must enter the threshold value, according to the following table.
- Absolute alarm on output value (full scale) can be associated only to AL2, AL3 and AL4.
4 - Operation

4.4.3 PARAMETERISATION - PID MENU  (not shown for ON-OFF control action)
4.4.4 PARAMETERISATION TUNING MENU
(not shown for ON-OFF control action)

4.4.5 PARAMETERISATION
INPUT MENU

Initial tune start (one shot tune) no/yes

Continuous Tune start Adaptive Tune (AT) no/yes

Filter time constant (user enabled/disabled) Off 0.2...99.9 seconds

Measure bias -60...60 digit

Sampling time 0.1...10.0 seconds

Calculated Proportional band (1) (display only) (available when adaptive tune is selected)

Calculated Integral time (1) (display only) (available when adaptive tune is selected)

Calculated derivative time (1) (display only) (available when adaptive tune is selected)

These values are not automatically stored on the PID menu parameters Pb, ti, td.
4 - Operation

4.4.6 PARAMETERISATION - OUTPUT MENU

- **Cycle time**
  - Time proportional only: 0.2…100.0 s

- **Control output low limit**
  - Not available in Heat/Cool configuration: 0…100%

- **Control output high limit**
  - 0…100%

- **Control output rate limit**
  - User enabled/disabled: 0.0…99.99% s

- **Control output soft start value**
  - User enabled/disabled: 0…100%

- **Soft start function activation time**
  - 1…9999 s

- **Motor travel time**
  - 15…600 seconds

- **Dead band**
  - 0.0…5.0%

- **Cool cycle time**
  - Time proportional only: 0.2…100.0 s

- **Cool control output high limit**
  - 0.0…100%

- **Cool output rate limit**
  - User enabled/disabled: 0.01…99.99%
4.4.7 PARAMETERISATION - SERIAL COMMUNICATION MENU

Depending on serial communication choosen (see model code on page 5), there are the following parameters:

- **SLAVE address**
  - Communication (if option installed): OFF / 1...247
  - **Address**: 0ff / 1…247

- **SLAVE baud rate**
  - 1200 / 2400 / 4800 / 9600 / 19200

- **SLAVE communication protocol**
  - MbuS / jbuS

- **Parity**
  - none / Even / odd

- **PROFIBUS DP address**
  - 3…124

- **MASTER enable**
  - no / yes

- **MASTER baud rate**
  - 1200 / 2400 / 4800 / 9600 / 19200

- **MASTER communication protocol**
  - MbuS / jbuS

- **Communication protocol**
  - MbuS / Jbus

For RS485 Modbus/Jbus SLAVE + MASTER, the following parameters are selected: Index c = 6.
4.5 PARAMETERS

For a simpler use of the controller, its parameters have been organised in menu, according to their functionality area.

### 4.5.1 SETPOINT MENU

**SP.L**
Setpoint low limit

**SP.H**
Setpoint high limit

High and low limit of the Setpoint SP. The minimum span (SP.L - SP.H) must be greater than 100 digit.

**SL.u**
Setpoint ramp up

**SL.d**
Setpoint ramp down

This parameter specifies the maximum rate of change of the Setpoint. Adjustable in digit/s, digit/minute and digit/hour (see page 27).

When the parameter is OFF, this function is disabled and the new Setpoint is reached immediately after being entered.

**Example**

When Remote Setpoint is configured, we suggest to disable **SL.u** and **SL.d** parameters OFF.

<table>
<thead>
<tr>
<th>1st stored Setpoint</th>
<th>2nd stored Setpoint</th>
<th>3rd stored Setpoint</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SP.1</strong></td>
<td><strong>SP.2</strong></td>
<td><strong>SP.3</strong></td>
</tr>
</tbody>
</table>

Values of the three Setpoints, that are activated by mean of logic inputs, communication parameters, and keyboard. The Setpoint active is indicated by the $1$, $2$ or $3$ green led.

See also page 56.

**Remote Setpoint Slope enable**

To enable or disable slopes when the remote Setpoint is active.
**Operation**

**Stored Setpoint tracking**

(see chapter 4.3.2 at page 27)

Two different operation modes can be set:

A- Stand-by mode

The memorised Setpoint is active until its command is active too. Then the controller goes back to the Local Setpoint which becomes the operating one.

B- Tracking mode

Once the memorised Setpoint is active, it remains operating also when it command is not active anymore.

*The previous Local Setpoint value will be lost.*

**Remote Setpoint Bias and Ratio**

Ratio is the coeff. which defines the remote Setpoint span with respect to the input span.

**Remote Setpoint**

Bias defines the starting point of analogue Remote Setpoint in eng. units corresponding to the low limit (current or voltage) of the remote signal.

PV = Process variable

LR = PV low limit

HR = PV high limit

SR = Remote Setpoint

a (a') = SR starting point

b (b') = SR ending point
4.5.1 SETPOINT MENU

If SR starting point is lower then the ending point, both expressed in engineering units:

\[ b \cdot dS = \text{starting point} = a \]

\[ r \cdot \alpha = \frac{b - a}{HR - LR} \]

E.g.: \( b \cdot dS = 20 \)

\[ r \cdot \alpha = \frac{100 - 20}{600 - (-200)} = 0.1 \]

If SR starting point is higher then the ending point, both expressed in engineering units:

\[ b \cdot dS = \text{starting point} = a \]

\[ r \cdot \alpha = \frac{b - a}{HR - LR} \]

E.g.: \( b \cdot dS = 100 \)

\[ r \cdot \alpha = \frac{20 - 100}{600 - (-200)} = -0.1 \]

Working Setpoint (SP) as combination of Local Setpoint (SL) and remote signal

Setpoint \( \text{Loc} \cdot \) (table 3, page 27)

\[ \text{SP} = \text{SL} + (r \cdot \alpha \cdot \text{REM}) + b \cdot dS \]

4.5.2 ALARM MENU

(see also pages 32 and 33)

- **hy-u**: Asymmetric upper alarm hysteresis
- **hy-d**: Asymmetric lower alarm hysteresis

**Example with high absolute alarm**

\[ \text{hy-d} \]

\[ \text{hy-u} \]

Alarm delay

Delay time for alarm activation. 

**OFF**: alarm activated immediately 

1...9999: alarm activated only if the condition persists for the set time

The parameter can be set between 0 and 5% of the configured Span and set in Engineering units. e.g.

- **Range**: -200...600°C
- **Span**: 800°C
- **Max. Hysteresis**: 5% 800°C = 40°C

For symmetrical hysteresis set

\[ \text{hy-d} = \text{hy-u} \]
4.5.3 PID MENU

Not present with On-Off main output.

Proportional Band

This parameter specifies the proportional band coefficient that multiplies the error (SP - PV).

Integral Time

It is the integral time value, that specifies the time required by the integral term to generate an output equivalent to the proportional term. When OFF the integral term is not included in the control algorithm.

Derivative Time

It is the time required by the proportional term P to reach the level of D. When OFF it is not included.

Overshoot control

(Automatically disabled when the adaptive tune is running)

This parameter specifies the span of action of the overshoot control. Setting lower values (1.00—>0.01) the overshoot generated by a Setpoint change is reduced. The overshoot control doesn’t affect the effectiveness of the PID algorithm.

Setting 1, the overshoot control is disabled.

Manual reset

This term specifies the value of the control output when PV = SP, in a PD only algorithm (lack of the Integral term).

Error

Inside this band for (PV - SP), the control output does not change to protect the actuator (output Stand-by).

4.5.4 TUNING MENU

(not shown for ON-OFF main control output)

See page also 57

Two tuning method are provided:

- Initial one shot Fuzzy-Tuning
- Continuous, self learning Adaptive Tuning

The Fuzzy-Tuning determines automatically the best PID term with respect to the process behaviour.

The controller provides 2 types of “one shot” tuning algorithm, that are selected automatically according to the process condition when the operation is started.

STEP response

Start of autotune operation

SP

End of the tuning operating and setting of the new calculated terms

PV variable

Control output
Continuous adaptive tune is particularly suitable for controlling process whose control characteristics change with time or are not linear in relation to the Setpoint values. It doesn’t require any operation by the user. It is simple and works fine: it samples continuously the process response to the various perturbations, determining the frequency and the amplitude of the signals. On the basis of this data and their statistical values, stored in the instrument, it modifies automatically the PID term parameters.

It is the ideal for all applications where it is required to change continuously the PID terms parameters, in order to adjust the PID to the changes of the process dynamic conditions.

In case of power off with the Adaptive Tune enabled, the values of the PID terms parameters are stored, in order to be reused at the next power on.

At power on the Adaptive Tune starts automatically.

---

4.5.4 TUNING MENU (Cont.)

Fuzzy-Tuning is selected when, at the start of the autotune operation, the PV is far from the Setpoint of more than 5% of the span. This method has the big advantage of fast calculation, with a reasonable accuracy in the term calculation.

The self-learning adaptive autotune is not intrusive. It doesn’t affect the process, at all, during the phase of calculation of the optimal terms parameters.

Continuous adaptive tune

Natural frequency is selected when the PV is close to the SP Setpoint. This method has the advantage of a better accuracy in the term calculation with a reasonable speed calculation.

The Fuzzy Tuning determines automatically the best method to use to calculate the PID term, according the process conditions.

The Fuzzy Tuning is selected when, at the start of the autotune operation, the PV is far from the Setpoint of more than 5% of the span. This method has the big advantage of fast calculation, with a reasonable accuracy in the term calculation.

The self-learning adaptive autotune is not intrusive. It doesn’t affect the process, at all, during the phase of calculation of the optimal terms parameters.

Continuous adaptive tune

Natural frequency is selected when the PV is close to the SP Setpoint. This method has the advantage of a better accuracy in the term calculation with a reasonable speed calculation.

The Fuzzy Tuning determines automatically the best method to use to calculate the PID term, according the process conditions.
4.5.5 INPUT MENU

Input filter

Time constant, in seconds, of the RC input filter on the PV input. When this parameter is Off, the filter is bypassed.

Filter response

Measure Bias

This value is added to the measured PV input value. Its effect is to shift the whole PV scale of its value (+60 digits).

Sampling Time

Sampling time, in seconds, of the instrument. This parameter is normally used when controlling slow process, increasing the sampling time from 0.1... 10 s.

4.5.6 OUTPUT MENU

Control output hysteresis

The parameter can be set between zero and 5% of the configured Span and set in Engineering units.

e.g. Range = -200...600°C
Span = 800°C
Max. Hyst. = 5% 800° = 40°C

Control output cycle time

This value, specified in %/seconds, with range from 0.01 to 99.99%/s provides the maximum rate of change of the output. When set to Off this function is disabled.

Soft start of the control output

It specifies the value at which the control output is set during the start up phase.

Soft start time

This value specifies the time the start up phase lasts. The start up phase starts at power up of the controller.

Travel time

It provides the time required to the motor positioner to go from the 0% position to 100%.

Minimum step

It specifies the minimum allowed time of activation of the output to a motor positioner that produces a sensible effect. It is related to the deadband of the positioner.
4 - Operation

**Heat/Cool deadband**
This parameter specifies the width of the deadband between the Cool and the Heat channel.

**Heat / Cool Algorithm**

**SP.L** Split Range % (split range only)
The value set as SP.L represents the percent of PID output managed by the main output (OP1 or OP5). The balance to 100% is managed by the secondary output (OP2 or OP6).

---

**E.g.**
- Cnty - SP.L 1
  - MCop = 4...20 (OP5)
  - SCop = 4...20 (OP6)
  - SP.L 1 = 30%
- OP5: 4 mA = 0% (PID output)
  - 20 mA = 30% (PID output)
- OP6: 4 mA = 30% (PID output)
  - 20 mA = 100% (PID output)

**Split Range Control action**
(split range only)
This parameter specifies the control action (direct or reverse) of the single action split range modes.
See table 5 at page 29:
- Cnty = SP.L 1... SP.L 4
4.5.7 SERIAL COMMUNICATION MENU (OPTION)

SLAVE address
communication
- 1…247

Slave Profibus
DP address
- 3…124

All the instrument connected to
the same supervisor must have
different addresses.
If set OFF the serial comm.s is
not active.

SLAVE
Baud rate

MASTER
Baud rate

It provides the baud rate in the
range from 1200 to 19200 bit/s

Parity

May be set even EVEN or odd
ODD.
If none is set, parity will be
excluded.

Three serial comm.s options
are available:

A - Modbus/Jbus SLAVE
The parameters value can be read
and when possible modified.

B - Modbus/Jbus MASTER
with Mathematical package
Mathematical package
The transmission and inquiry of
parameters value to all the
deVICES using Modbus/Jbus SLAVE (e.g. PLC, etc.)
is allowed.

The mathematical package can
manipulate the received data by
means the serial comm.s.

Example:
The MASTER (X5) reads the
process variable from SLAVE 1
(C1) and SLAVE 2 (X3). It com-
pares the two values and send the
higher to the SLAVE 3 (PLC).

The available math. operations
are:

To define the controller operations
of this option, the configuration
software must be used [1].

C - PROFIBUS DP SLAVE
(Process Field bus protocol)
Industrial standard for peripheral
devices connection to a machine
in a plant.
The protocol installed in this con-
troller, offers the following advan-
tages against the standard normally
supplied by other suppliers:
• Communications baudrate
  Up to 12 Mb/s with electric
  isolation.
• The list of data transfer (profile
  file) is user configurable.
  It can be set by means the
  configuration software [1].

Notes:
[1] Please, read the user
manual: [1]
“gamma due® and
delta due® controller series
serial communication and
configuration software”.

4 - Operation

4.6 PARAMETERISATION - ACCESS MENU - PASSWORD - CALIBRATION

- **Operator mode**
  - Press until
  - Enter password for access enable
  - From -999 to 9999 (11 default value from factory)

- **Access menu**
  - Access to all the levels

- **Execute the following operations**
  - A/M enable

- **Change the Configuration password**

- **Access configuration page** displayed.

- **Pressing go back to the Operator mode**

- **Operator level Access**

- **Full Access to all the levels**

- **Oper Access**

- **Enter the Configuration password**
During the up-download of the data to/from the Memory chip, the controller display shows the segment clockwise rotation of the digits.

**Access to the edit level**
- **Edit**
- **Access**

**Change the Access password**
- **APAS**

**Load the data from Memory chip**
- **Load**
- **EH2c**

**Download the data to Memory chip**
- **Store**
- **EH2c**

**Calibrate the potentiometer (if present)**

**The valve go to low scale**

**When the indication (the valve) is stopped, confirm the calibration value using**
- $+$
- $-$

**The valve go to full scale**

**Confirm and return back to the Operator mode**
- **Confirm**
- **Back**
- **Operator**
With the access level Edit, the user defines which groups and parameters are accessible to the operator.

After selecting and confirming the access level Edit, enter in the parameters menu. The code of the access level is displayed on the front panel.

Press the \[ \% \] keys to select the proper level.

<table>
<thead>
<tr>
<th>Group of parameters</th>
<th>Code</th>
<th>Access level</th>
</tr>
</thead>
<tbody>
<tr>
<td>( P_id )</td>
<td></td>
<td>Visible</td>
</tr>
<tr>
<td>( K_id )</td>
<td></td>
<td>Not visible</td>
</tr>
</tbody>
</table>

The parameters in the access level \( P_id \) are recalled on the front panel through the procedure of fast parameter access illustrated in par. 5.2 page 53. The maximum number of fast parameters is 10.

At the end of the parameter list of the selected group, the controller quits from the Edit access level.

Therefore, the Edit level must be selected for each group of parameters.

The access level of groups and parameters, is activated through...
5.1 STANDARD DISPLAY

5.2 FAST VIEW

With this procedure, simple and fast, up to 10 parameters, selected through the fast view (see par 4.6 page 52) are displayed and can be modified by the operator without requiring the standard parameter setting procedure.

Press in order to modify the parameters.

The value is entered by pressing key.

On left side, please find as an example a list of parameters on Fast view menu.
The commands can be entered in 3 ways:

6.1 KEYPAD
- Setpoint modification
- Manual mode
- Local/remote selection
- Stored Setpoint display
- Tune Run / Stop
- Program start/stop
(see page 66)

6.2 DIGITAL INPUTS
- see page 58

6.3 SERIAL COMMUNICATIONS
- see the manual on this topic
6.1 KEYPAD COMMANDS

6.1.1 SETPOINT MODIFICATION

The Setpoint is directly modified with the $% keys. Once entered, the new value is checked and becomes operating after 2 seconds. The end of this phase is flagged by flashing momentarily the display with SP.

Example of Setpoint modification from 275.0 to 350.0

Modified Setpoint value after 2 seconds

Flash momentarily the SP value to confirm that it has become operating.

Back to the operator mode

6.1.2 AUTO/MANUAL MODE

Select manual green led on

Modification of control output value

The new value is immediately working without any confirm.

The bumpless action is present switching between AUTO, MAN and vice versa.

In case of power failure, the AUTO/MAN status and the output value remain stored in the controller memory.
6 - Commands

6.1.3 LOCAL/REMOTE SELECTION

The selected Setpoint becomes operating pressing the \( \text{è} \) key. When in Remote, the green led is on.

6.1.4 STORED SETPOINTS SELECTION (see also pages 42, 43)

The Setpoint is directly modified with the \( \text{ù} \), \( \text{ù} \), \( \text{û} \) keys. Once entered, the new value is checked and becomes operating after 2 seconds. The end of this phase is flagged by flashing momentarily the display with SP.

The three \( \text{ù} \), \( \text{ù} \), \( \text{û} \) leds flag the Setpoint operating.

Once entered, the new value is checked and becomes operating after 2 seconds. The end of this phase is flagged by flashing momentarily the display with SP.
6.1.5 TUNE RUN / STOP

This controller is provided with 2 different Tuning algorithm:
- **Fuzzy tune (one shot tune)** for calculating the optimal PID terms parameters.
- **Adaptive Tune (continuous tune)** for a continuous calculation of the PID terms parameters.

After the execution of the tuning, the calculated values are automatically presented in the PID menu.

When this function is in progress, the calculated values are visible in the Tuning menu but cannot be modified.
6 - Commands

6.2 DIGITAL INPUTS COMMANDS

A function is assigned, through the configuration procedure to each IL1, IL3 and IL3 digital input. (see the parameters setting at tab. 10 at page 30).

The configured function is activated when the digital input (free voltage contact or open collector output) is in the On state (closed). It is deactivated by setting the input to the Off state (open).

The activation of the function through the digital input has the highest priority than through the keypad or through the serial communication.

### 6.2.1 DIGITAL INPUTS COMMANDS FOR LOCAL-REMOTE SETPOINT

<table>
<thead>
<tr>
<th>Function</th>
<th>Parameter value</th>
<th>Performed operation</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>#OFF</td>
<td>Off</td>
<td>Not used</td>
</tr>
<tr>
<td>Set manual mode</td>
<td>#Mana</td>
<td>Automatic Manual</td>
<td></td>
</tr>
<tr>
<td>Keyboard lock</td>
<td>#Peb.1</td>
<td>Unlock</td>
<td>Locked</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>With the keypad locked the commands from digital inputs and serial communications are still operating</td>
</tr>
<tr>
<td>PV measure hold</td>
<td>#H.PU</td>
<td>Normal operation</td>
<td>PV is hold</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>The value of PV is “frozen” at the time the digital input goes to the close state</td>
</tr>
<tr>
<td>Setpoint slopes inhibition</td>
<td>#Slo.1</td>
<td>Rate limiting is active</td>
<td>Normal operation</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>When the input is in the On state, the Setpoint is changed in steps</td>
</tr>
<tr>
<td>Output forcing mode</td>
<td>#F.Out</td>
<td>Normal output</td>
<td>Forced output</td>
</tr>
<tr>
<td>1st stored Setpoint</td>
<td>#S.p.1</td>
<td>Local</td>
<td>1st SP</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>The permanent closure forces the chosen stored value. Setpoint modification is not possible.</td>
</tr>
<tr>
<td>2nd stored Setpoint</td>
<td>#S.p.2</td>
<td>Local</td>
<td>2nd SP</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>The impulsive closure selects the stored value. Setpoint modification is allowed.</td>
</tr>
<tr>
<td>3rd stored Setpoint</td>
<td>#S.p.3</td>
<td>Local</td>
<td>3rd SP</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>If more than one digital input is selecting a Setpoint, the last to be activated is the operating one (see page 43)</td>
</tr>
<tr>
<td>Set Remote mode</td>
<td>#r</td>
<td>Local</td>
<td>Remote</td>
</tr>
<tr>
<td>Reactivation of Blocking</td>
<td>#blk</td>
<td>—</td>
<td>Blocking Reactivation</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>The blocking function is activated on closing the command from digital inputs</td>
</tr>
<tr>
<td>Alarm Acknowledge</td>
<td>#ack</td>
<td>—</td>
<td>Alarm Acknowledge</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>The Alarms are acknowledged as soon as the digital input is closed</td>
</tr>
</tbody>
</table>
PROGRAMMED SETPOINT

INTRODUCTION
When the Setpoint programmer option (mod. X5-3… 4) is present, up to four programs are available.

MAIN CHARACTERISTICS
• 4 program, 16 segments max/program
• start, stop, hold etc. commands from the keypad
• time base in seconds, minutes or hours
• continuous or up to 1…9999 time cycling of the program
• two digital outputs (OP3 and OP4) related to the program.
• setting of the maximum allowed deviation from the Setpoint

7.1 PROGRAM STRUCTURE
The program consists of a sequence of segments.
For each segment, it is specified:
• the Setpoint to reach SP
• the duration of the segment ti.
• the state of the OP3 output

The program consists of:
• 1 initial segment named 0
• 1 end segment named F
• 1…14 normal segments

Initial segment - 0
Its main purpose is to define the value the process variable has to maintain before starting the program.

End segment - F
Its main purpose is to define the value the process variable has to maintain at the end of the program and until further changes of Setpoint.

Normal segments
These segments build up the profile program. There are 3 types of segments:
- Ramp
- Dwell
- Step
7.2 SETPOINT PROGRAMMER

7.2.1 MAXIMUM ALLOWED DEVIATION (band)

If the PV controlled input value exceeds the band, centred around the SP, the segment time is extended of the same time the PV input stays out of the band. The band width is defined in a parameter of the program segment. The actual segment period is calculated as $t_i = t_i + T_i$.
**7.2.2 RE-START OF A PROGRAM AFTER A POWER FAILURE**

The parameter \( \text{FAIL} \) specifies the behaviour of the programmer at power up (see page 62). Selected between the following 3 choices:

- **Cont** Continue
- **Reset** Reset
- **Ramp** Ramp

If **Cont** is selected, the execution of the program starts from the point reached at the power failure time. All the parameters, like Setpoint and the remaining time are restored at the values they had at power off.

If **Ramp** is selected, the execution of the program starts from the point reached at the power failure time. In this case, the programs continue with PV reaching SP with a ramp, whose slope corresponds to the one of the segment running at the power off.

If **Reset** is selected, at power on the program ends and goes back to local mode.
7 - Programmed Setpoint

7.3 PARAMETERISATION - PROGRAM MENU (OPTION)

Two digital outputs are provided to be configured for program purposes. These outputs are usually OP3 and OP4. If this functionality is not required, it can be inhibited by setting OFF the corresponding parameter.
7 - Programmed Setpoint

Continue for all the 14 normal segments

Back to the 1st parameter
7.4 PROGRAM STATUS DISPLAYING

The function mode of the program as well as its status is displayed clearly by means of the RUN and HLD LEDs as follows:

On program run mode, each 3s the display shows alternatively:
- number of running program;
- number of operating segment as well as its status.

The control output value can be displayed during the program run using the procedure at page 53.

<table>
<thead>
<tr>
<th>Function</th>
<th>Status</th>
<th>Led RUN</th>
<th>Led HLD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local Reset</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
</tr>
<tr>
<td>Program run</td>
<td>Run</td>
<td>ON</td>
<td>OFF</td>
</tr>
<tr>
<td>Program hold</td>
<td>Hold</td>
<td>ON</td>
<td>ON</td>
</tr>
<tr>
<td>Program hold for PV outside Error band</td>
<td>Hold back</td>
<td>ON</td>
<td>ON</td>
</tr>
<tr>
<td>Program end (reset)</td>
<td>End</td>
<td>OFF</td>
<td>OFF</td>
</tr>
</tbody>
</table>

On program run mode, each 3s the display shows:
- Number of running Program (program No. 3)
- Operating segment and its status
- (Segment No.12) - ramp up
- (Segment No.12) - ramp down
- (Segment No.12) - dwell
- (End segment) - Program end
The various commands, supported by the controller, are different for each of the following operating phases:
A) when in Local Setpoint mode
B) during the execution of a program
C) when the program is in hold

Commands supported by the controllers

7.5 START/STOP OF A PROGRAM

The different phases are displayed in a chained way, just for easing the understanding of the functionality.

Two different modes for starting and stopping a program are provided:
- direct mode with the key (see page 66)
- through the parameter menu (see page 67)
7.5.1 START/STOP OF A PROGRAM BY DIRECT MODE WITH

Note:
To reset the program see procedure at page 67
7.5.2 START/HOLD/STOP OF A PROGRAM THROUGH THE PARAMETER MENU

Reset procedure

- Press until
- Operator mode (local Setpoint)
- Program menu
- No. of program
- Program selection
- Program running led continuously on
- Program hold led continuously on
- Program start
- Program hold
- Program reset
## 7.5.3 DIGITAL INPUT COMMANDS FOR SETPOINT PROGRAMMER FUNCTION (OPTION)

<table>
<thead>
<tr>
<th>Function</th>
<th>Parameter value</th>
<th>Performed operation</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>OFF</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Set manual mode</td>
<td>ON</td>
<td>Automatic</td>
<td>Manual</td>
</tr>
<tr>
<td>Keyboard lock</td>
<td>KEYON</td>
<td>Unlock</td>
<td>Locked</td>
</tr>
<tr>
<td>PV measure hold</td>
<td>HPU</td>
<td>Normal operation</td>
<td>PV is held</td>
</tr>
<tr>
<td>Setpoint slopes inhibition</td>
<td>SLOPE</td>
<td>Rate limiting is active</td>
<td>Normal operation</td>
</tr>
<tr>
<td>Output forcing</td>
<td>FOUT</td>
<td>Normal operation</td>
<td>Forced output value</td>
</tr>
<tr>
<td>1st Program selection</td>
<td>P9.1</td>
<td>Local</td>
<td>1st program</td>
</tr>
<tr>
<td>2nd Program selection</td>
<td>P9.2</td>
<td>Local</td>
<td>2nd program</td>
</tr>
<tr>
<td>3rd Program selection</td>
<td>P9.3</td>
<td>Local</td>
<td>3rd program</td>
</tr>
<tr>
<td>4th Program selection</td>
<td>P9.4</td>
<td>Local</td>
<td>4th program</td>
</tr>
<tr>
<td>Program Start/Hold</td>
<td>r.H</td>
<td>HOLD</td>
<td>RUN</td>
</tr>
<tr>
<td>Program reset</td>
<td>r5€</td>
<td>Normal operation</td>
<td>Program reset</td>
</tr>
<tr>
<td>Deactivation of blocking</td>
<td>BL c €</td>
<td>–</td>
<td>Reactivation of blocking</td>
</tr>
<tr>
<td>Next segment</td>
<td>n2HL</td>
<td>–</td>
<td>Skips to the next segment</td>
</tr>
</tbody>
</table>

Notes:
- Automatic: Manual
- Rate limiting is active: Normal operation
- The value of PV is “frozen” at the time the digital input goes to the close state
- When the input is in the on state, the Setpoint is changed in steps
- Digital input ON means activation forcing output value (see page 28)
- Program selection by permanent closure of the digital input
- When the input is in the On state, the program is executed up to the end. When off, the program is forced in hold.
- When the input is in the On state, the program reset and control switching to local setpoint
- The blocking function is activated at the time the digital input goes to the close state
- The program skips to the next segment of the program at the time the digital input goes to the close state
## TECHNICAL SPECIFICATIONS

<table>
<thead>
<tr>
<th>Features at 25°C env. temp.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total configurability</strong> (see chapter 4.3 page 25)</td>
<td>From keypad or serial communication the user selects: - the type of input - the type of Setpoint - the type of control algorithm - the type of output - the type and functionality of the alarms - control parameter values - access levels</td>
</tr>
</tbody>
</table>

### Common characteristics

- A/D converter with resolution of 160000 points
- Update measurement time: 50 ms
- Sampling time: 0.1…10.0 s Configurable
- Input shift: -60…+60 digit
- Input filter with enable/disable: 0.1…99.9 seconds

<table>
<thead>
<tr>
<th>Accuracy</th>
<th>Between 100…240Vac the error is minimal</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.25% ±1 digits for temperature sensors</td>
<td>0.1% ±1 digits (for mV and mA)</td>
</tr>
</tbody>
</table>

### PV Input

(see pages 13, 14 and page 26)

#### Resistance thermometer

(for $\Delta T$: $R_1 + R_2$ must be $<320\Omega$)

- Pt100Ω $a 0^\circ C$ (IEC 751)
- $^\circ C$/$^\circ F$ selectable
- 2 or 3 wires connection
- Burnout (with any combination)

<table>
<thead>
<tr>
<th>Resistance thermometer (for $\Delta T$: $R_1 + R_2$ must be $&lt;320\Omega$)</th>
<th>Between 100…240Vac the error is minimal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pt100Ω $a 0^\circ C$ (IEC 751)</td>
<td>2 or 3 wires connection Burnout (with any combination)</td>
</tr>
</tbody>
</table>

### DC input (current)

- 4…20mA, 0…20mA $R_j = 30\Omega$

<table>
<thead>
<tr>
<th>DC input (current)</th>
<th>Between 100…240Vac the error is minimal</th>
</tr>
</thead>
<tbody>
<tr>
<td>4…20mA, 0…20mA $R_j = 30\Omega$</td>
<td>2 or 3 wires connection Burnout (with any combination)</td>
</tr>
</tbody>
</table>

### DC input (voltage)

- 0…50mV, 0…300mV $R_j > 10M\Omega$
- 1…5, 0…5, 0…10V $R_j > 10k\Omega$

<table>
<thead>
<tr>
<th>DC input (voltage)</th>
<th>Between 100…240Vac the error is minimal</th>
</tr>
</thead>
<tbody>
<tr>
<td>0…50mV, 0…300mV $R_j &gt; 10M\Omega$</td>
<td>2 or 3 wires connection Burnout (with any combination)</td>
</tr>
</tbody>
</table>

### Frequency (option)

- 0…2,00…20,0kHz

<table>
<thead>
<tr>
<th>Frequency (option)</th>
<th>Between 100…240Vac the error is minimal</th>
</tr>
</thead>
<tbody>
<tr>
<td>0…2,00…20,0kHz</td>
<td>2 or 3 wires connection Burnout (with any combination)</td>
</tr>
</tbody>
</table>
8 - Technical Specifications

**Features at 25°C env. temp.**

**Remote Setpoint**

- Not isolated accuracy 0.1%
- Current: 0/4...20mA: $R_j = 30\,\Omega$
- Voltage: 1...5, 0...5, 0...10V: $R_j = 300\,k\Omega$

**Bias in engineering units and ± range**

- Ratio: -9.99...+99.99
- Local + Remote Setpoint Voltage: 1...5, 0...5, 0...10V: $R_j = 300\,k\Omega$

**Potentiometer**

- 100Ω...10kΩ
- Feedback valve position

**Digital inputs**

- 3 logic
- The closure of the external contact produces any of the following actions:
  - Auto/Man mode change, Local/Remote Setpoint mode change, 3 Stored Setpoint activation, keyboard lock, measure hold, slope inhibit and output forcing
  - Program Hold/Run (if option installed), Program Selection and Skip to Next Segment

<table>
<thead>
<tr>
<th>Operating mode and Outputs</th>
<th>Control output</th>
<th>Alarm AL1</th>
<th>Alarm AL2</th>
<th>Alarm AL3</th>
<th>Alarm AL4</th>
<th>Retransmission</th>
</tr>
</thead>
</table>

**Valve drive**

- OP1 Relay/Triac
- OP2 Relay/Triac
- OP3 Relay/Triac
- OP4 Relay/Triac
- OP5 Analog/Digital
- OP6 Analog/Digital
### Technical Specifications

#### Features

**at 25°C.env. temp.**

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Algorithm</td>
<td>PID with overshoot control/ON-OFF - PID with valve drive algorithm, for controlling motorised positioners</td>
</tr>
<tr>
<td>Proportional band (P)</td>
<td>0.5…999.9%</td>
</tr>
<tr>
<td>Integral time (I)</td>
<td>1…9999 s</td>
</tr>
<tr>
<td>Derivative time (D)</td>
<td>0.1…9999.9 s</td>
</tr>
<tr>
<td>Error dead band</td>
<td>0.1…10.0 digit</td>
</tr>
<tr>
<td>Overshoot control</td>
<td>0.01…1.00</td>
</tr>
<tr>
<td>Manual reset</td>
<td>0…100%</td>
</tr>
<tr>
<td>Cycle time (Time proportional only)</td>
<td>0.2…100.0 s</td>
</tr>
<tr>
<td>Min./Max output limits</td>
<td>0…100% separately adjustable</td>
</tr>
<tr>
<td>Control output rate limit</td>
<td>0.01…99.99%/s</td>
</tr>
<tr>
<td>Soft-start output value</td>
<td>1…100% - Time 1…9999 s</td>
</tr>
<tr>
<td>Output safety value</td>
<td>-100…100%</td>
</tr>
<tr>
<td>Control output forcing value</td>
<td>-100…100%</td>
</tr>
<tr>
<td>Control output hysteresis</td>
<td>0…5% Span in engineering units</td>
</tr>
<tr>
<td>Dead band</td>
<td>0…5.0%</td>
</tr>
<tr>
<td>Cool proportional band (P)</td>
<td>0.5…9999.9%</td>
</tr>
<tr>
<td>Cool integral time (I)</td>
<td>1…9999 s</td>
</tr>
<tr>
<td>Cool derivative time (D)</td>
<td>0.1…9999.9 s</td>
</tr>
<tr>
<td>Cool cycle time (Time proportional only)</td>
<td>0.2…100.0 s</td>
</tr>
<tr>
<td>Control output high limit</td>
<td>0…100%</td>
</tr>
<tr>
<td>Cool output max. rate</td>
<td>0.01…99.99%/s</td>
</tr>
<tr>
<td>Motor travel time</td>
<td>15…600 s</td>
</tr>
<tr>
<td>Motor minimum step</td>
<td>0.1…5.0%</td>
</tr>
<tr>
<td>Feedback potentiometer</td>
<td>10kΩ … 10kΩ</td>
</tr>
</tbody>
</table>

#### Control mode

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single action PID algorithm</td>
<td></td>
</tr>
<tr>
<td>Off</td>
<td>0</td>
</tr>
<tr>
<td>Cool cycle time (Time proportional only)</td>
<td>0.2…100.0 s</td>
</tr>
<tr>
<td>Cool output max. rate</td>
<td>0.01…99.99%/s</td>
</tr>
<tr>
<td>Motor travel time</td>
<td>15…600 s</td>
</tr>
<tr>
<td>Motor minimum step</td>
<td>0.1…5.0%</td>
</tr>
<tr>
<td>Feedback potentiometer</td>
<td>10kΩ … 10kΩ</td>
</tr>
<tr>
<td>Valves drive PID algorithm</td>
<td>Raise/Stop/Lower</td>
</tr>
<tr>
<td>Off</td>
<td>0</td>
</tr>
</tbody>
</table>

---

**8 - Technical Specifications**

---
## Technical Specifications

### Features at 25°C env. temp.

<table>
<thead>
<tr>
<th>Description</th>
<th>OP1-OP2 outputs</th>
<th>OP3 output</th>
<th>OP4 output</th>
</tr>
</thead>
<tbody>
<tr>
<td>OP1-OP2 outputs</td>
<td>SPST Relay N.O., 2A/250Vac (4A/120Vac) for resistive load</td>
<td>SPDT relay N.O., 2A/250Vac (4A/120Vac) for resistive load</td>
<td>SPST relay N.O. 2A/250Vac (4A/120Vac) for resistive load</td>
</tr>
<tr>
<td>OP3 output</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OP4 output</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Analogue/digital

#### OP5 and OP6 (option) outputs

<table>
<thead>
<tr>
<th>Description</th>
<th>Action</th>
<th>Action type</th>
<th>Deviation threshold</th>
<th>Band threshold</th>
<th>Absolute threshold</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analogue: 0/1...5V, 0/10V, 500Ω/20mA max., 0/4/20mA, 750Ω/15V max.</td>
<td>Active high</td>
<td>±range</td>
<td></td>
<td>0... range</td>
<td>whole range</td>
</tr>
<tr>
<td>Digital: 0/24Vdc ±10%; 30mA max.</td>
<td>Active low</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### AL1 - AL2 - AL3 - AL4 alarms

<table>
<thead>
<tr>
<th>Description</th>
<th>Special functions</th>
<th>Sensor break, heater break alarm</th>
<th>Acknowledge (latching), activation inhibit (blocking)</th>
<th>Connected to Timer or program (if options installed) (only OP3-OP4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hysteresis 0...5% Span in engineering units</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Setpoint

<table>
<thead>
<tr>
<th>Description</th>
<th>Up and down ramps</th>
<th>Low limit: from low range to high limit</th>
<th>High limit: from low limit to high range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local + 3 memorised</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Remote only</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Local and Remote</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Local with trim</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Remote with trim</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Programmable</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Additional

- Galvanic isolation: 500 Vac/1 min
- Short circuit protected
- Resolution: 12 bit
- Accuracy: 0.1 %
- Active low
- Analog/digital
- 0/24Vdc ±10%; 30mA max.
- for solid state relay
- Action type
- Deviation threshold ±range
- Band threshold 0... range
- Absolute threshold whole range
### Technical Specifications

<table>
<thead>
<tr>
<th>Features at 25°C env. temp.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Programmable Setpoint</strong> (optional)</td>
<td>4 programs, 16 segments (1 initial and 1 end) From 1 to 9999 cycles or continuous cycling (OFF) Time values in seconds, minutes and hours Start, stop, hold, etc. activated from the keypad, digital input and serial communications</td>
</tr>
<tr>
<td><strong>Tuning</strong></td>
<td>Fuzzy-Tuning type: The controller selects automatically the best method according to the process conditions Step response Adaptive tune: self-learning, not intrusive, analysis of the process response to perturbations and continuously calculation of the PID parameters</td>
</tr>
<tr>
<td><strong>Auto/Man station</strong></td>
<td>Standard with bumpless function, by keypad, digital input or serial communications</td>
</tr>
<tr>
<td><strong>Serial comm.</strong> (option)</td>
<td>RS485 isolated, SLAVE Modbus/Jbus protocol, 1200, 2400, 4800, 9600, 19.200 bit/s, 3 wires RS485 isolated, MASTER Modbus/Jbus protocol, 1200, 2400, 4800, 9600, 19.200 bit/s, 3 wires RS485 asynchronous/isolated, PROFBUS DP protocol, from 9600 bit/s at 12MB/s selectable, max. length 100m (at 12 Mb/s)</td>
</tr>
<tr>
<td><strong>Auxiliary Supply</strong></td>
<td>+24Vdc ± 20%, 30mA max. - for external transmitter supply</td>
</tr>
<tr>
<td><strong>Operational safety</strong></td>
<td>Measure input: Detection of out of range, short circuit or sensor break with automatic activation of the safety strategies and alerts on display Control output: Safety and forcing value -100...100% separately adjustable Parameters: Parameter and configuration data are stored in a non volatile memory for an unlimited time Access protection: Password to access the configuration and parameters data - Fast view</td>
</tr>
<tr>
<td><strong>Power supply</strong> (PTC protected)</td>
<td>100...240Vac (-15% +10%) 50/60Hz or 24Vac (-15% +25%) 50/60Hz and 24Vdc (-15% +25%) Power consumption 5W max.</td>
</tr>
<tr>
<td><strong>General characteristics</strong></td>
<td>Safety: Compliance to EN61010-1 (IEC T010–1), installation class 2 (2500V) pollution class 2 Instrument class II Electromagnetic compatibility: Compliance to the CE standards (see page 2) UL and cUL Approval: File 176452 Protection EN60529 (IEC 529) IP65 front panel Dimensions: 1/8 DIN - 48 x 96, depth 110 mm, weight 380 g max.</td>
</tr>
</tbody>
</table>
WARRANTY

We warrant that the products will be free from defects in material and workmanship for 3 years from the date of delivery. The warranty above shall not apply for any failure caused by the use of the product not in line with the instructions reported on this manual.
<table>
<thead>
<tr>
<th><strong>ICONS TABLE</strong></th>
<th><strong>Main universal input</strong></th>
<th><strong>Digital input</strong></th>
<th><strong>Digital input connected functions</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Thermocouple</td>
<td>Isolated contact</td>
<td>Auto/Manual</td>
</tr>
<tr>
<td></td>
<td>RTD (Pt100)</td>
<td>NPN open collector</td>
<td>Run, Hold, Reset and program selection</td>
</tr>
<tr>
<td></td>
<td>Delta Temp (2x RTD)</td>
<td>TTL open collector</td>
<td>PV hold</td>
</tr>
<tr>
<td></td>
<td>mA and mV</td>
<td></td>
<td>Setpoint slopes inhibition</td>
</tr>
<tr>
<td></td>
<td>Custom</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Frequency</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Auxiliary input</strong></td>
<td>Current transformer</td>
<td></td>
<td>Output</td>
</tr>
<tr>
<td></td>
<td>mA Remote setpoint</td>
<td></td>
<td>SPST Relay</td>
</tr>
<tr>
<td></td>
<td>Volt Remote setpoint</td>
<td></td>
<td>Triac</td>
</tr>
<tr>
<td></td>
<td>Feedback potentiometer</td>
<td></td>
<td>SPD Relay</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>mA</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>mA mV</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Logic</td>
</tr>
</tbody>
</table>
## ASCON’S WORLDWIDE SALES NETWORK

### SUBSIDIARIES

**FRANCE**  
ASCON France  
Phone: +33 (0) 1 64 30 62 62  
Fax: +33 (0) 1 64 30 84 98  

Agence Sud-Est  
Phone: +33 (0) 4 74 27 82 81  
Fax: +33 (0) 4 74 27 81 71

**USA**  
ASCON Corporation  
Phone: +1 630 482 2950  
Fax: +1 630 482 2956

### DISTRIBUTORS

<table>
<thead>
<tr>
<th>Country</th>
<th>Distributor</th>
<th>Phone</th>
<th>Fax</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ARGENTINA</strong></td>
<td>Meditecna S.R.L.</td>
<td>+5411 4585 7005</td>
<td>+5411 4585 3434</td>
</tr>
</tbody>
</table>
| **FINLAND & ESTONIA** | THT Control oy | +358 3 212 9400  
|               |                                    | +358 3 212 9404 |
| **GERMANY**   | MBE Industrie Elektronik GmbH      | +49 2365 915 220  
|               |                                    | +49 2365 915 225 |
| **Greece**    | Control System                     | +30 31 521 055-6  
|               |                                    | +30 31 515 495  |
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