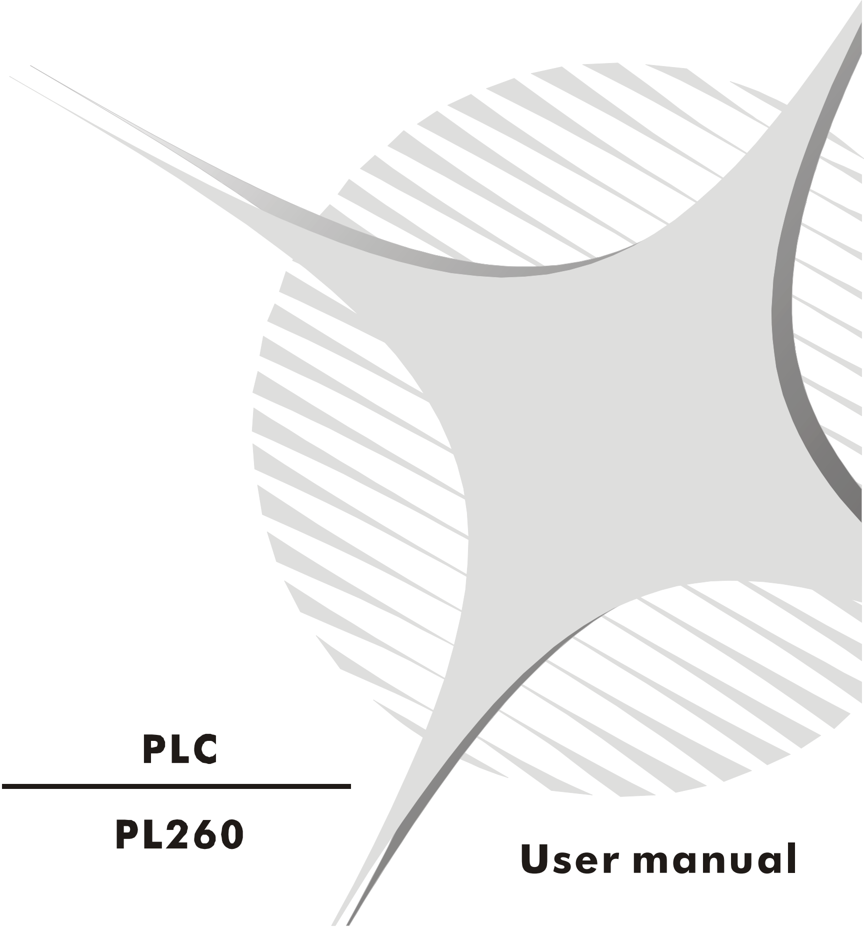
PIXSYS

electronics



PLC

PL260

User manual

1 Acquisition and actuation module PL260

1.1 Introduction

The PL260 is a compact PLC for the acquisition of analogue and digital signals and the execution of complex mathematical functions. One of the most important features on PL260 is the logic blocks, which allow simple management of complex operations.

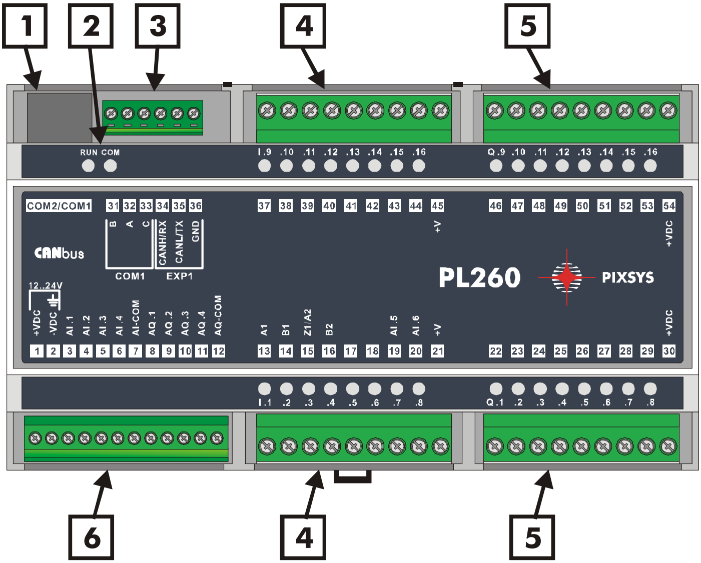
The module may be placed beside the plant to control and communicate with a central controller through RS-485 (galvanically isolated), allowing simplified signal wiring and increased noise immunity. The DIN rail mounting housing has been developed according to CE requirements for light and heavy industry.

Main features	
Operating conditions	Temperature 0-45 °C, Humidity 35..95uR%
Box	DIN rail mounting, self-extinguishing UL94 V0
Sealing	Box IP30
Weight	Approx. 350 gr.
Dimensions	90 x 160, depth 58 mm

Order codes:

PL260 -	□	□	□	
Outputs	1			16 static outputs 4 analogue 0..10V
Inputs		1		4 analogue inputs, 16 bit resolution 16 digital inputs 2 bidirectional encoders
		2		4 analogue inputs, 16 bit resolution 16 digital inputs 5 fast count inputs
Power-supply			AD	12…24V DC

1.2 Front panel and main features



N°	Description
1	Plug connector for serial communication COM1 and COM2
2	Green led **RUN**: • **ON** → PLC is in RUN mode and is executing the instructions programmed by ladder language. • **Slowly flashing** → 0,5 s on / 0,5 s off) PL260 is used as I/O module (no ladder program loaded). • **Fast flashing** → (0,2 s on / 0,2 s off) only boot program is loaded on PL260 (no main program and no ladder application) Yellow led **COM**: • **ON** → for 50mS during transmission of each frame on one of the available serial ports • **ON** → always during ladder programming or maintenance of PLC (updating main program)
3	Expansion terminal block for COM1 and EXP1 serial
4	Terminal block for digital inputs with led to signal active input
5	Terminal block for digital outputs with led to signal active outputs
6	Power-supply terminal block, analogue inputs/outputs

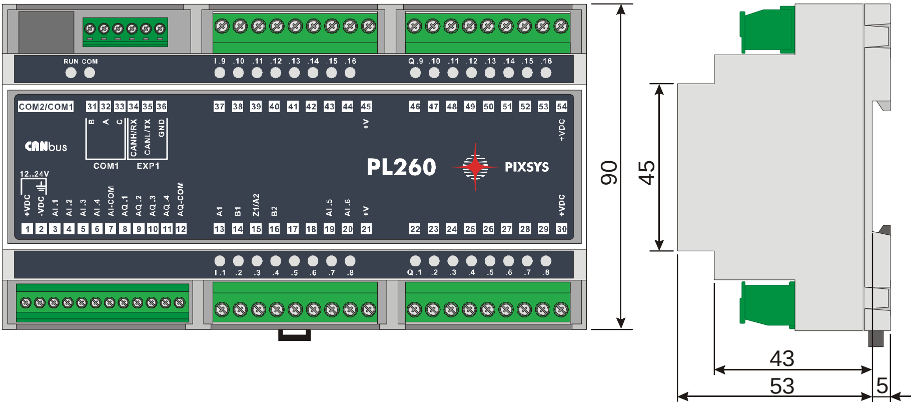
1.3 Main hardware features

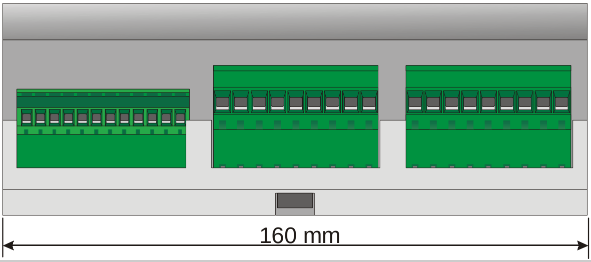
Hardware		
Power-supply	12...24 Vdc 6VA	
Analogue inputs	AI1..AI4	Voltage 0-10V (resolution 10 bit) Voltage 0-10V (resolution 16 bit) Voltage 0-1V (resolution 16 bit) Voltage 0-20mV (resolution 16 bit) Current 0-20mA (resolution 16 bit) Current 4-20mA (resolution 16 bit) Thermocouple K, S, T, R, J, E Input PT100, NI100 (2 or 3 wires) Input NTC-10K = β3435 Input PT1000, PT500, PTC-1K
Encoder inputs[1]	I1/A1÷I2/B1	Inputs PNP (0-24VDC) or 1st input for bidirectional encoder (25 KHz)
	I3/A2÷I4/B2	Inputs PNP (0-24VDC) or 2nd input for bidirectional encoder (25 KHz)
Fast count inputs[2]	I1,I2,I15,I16, I3	Input PNP (0-24VDC) or fast count inputs.
Digital inputs	I1÷I16	Inputs PNP (0-24VDC)
Digital outputs	Q1÷Q16	Static outputs: 24Vdc - 0,7A max. Each output can produce 0.7A with a combined limit of 4.0A.
Analogue outputs	AQ1÷AQ2	Voltage 0-10V (resolution 8 bit)
	AQ3÷AQ4	Voltage 0-12,5V (resolution 14 bit)
Serial ports	COM1	RS485 available on terminal block (A,B,C) and on COM plug-8 poles (galvanically isolated).
	EXP1	RS232 available on terminal block (non isolated). CAN bus for I/O expansion.
	COM2	RS232 available on COM plug-8 poles (non isolated).

[1] First encoder input uses hardware inputs I1 and I2. Second encoder input uses hardware inputs I3 and I4. If encoder inputs are used, the relevant digital inputs are not available. Max. frequency for encoders is 25 KHz if not used contemporarily, 15 KHz if both inputs are used contemporarily.

[2] On PL260-12AD.

1.4 Size and installation





Attacco a guida DIN EN50022
Din rail mounting guide EN50022

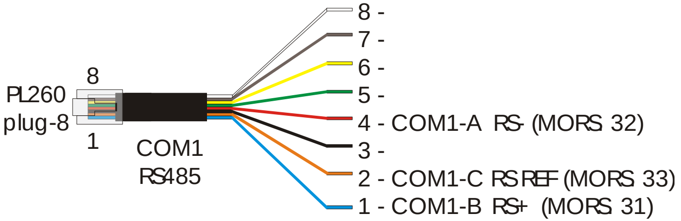
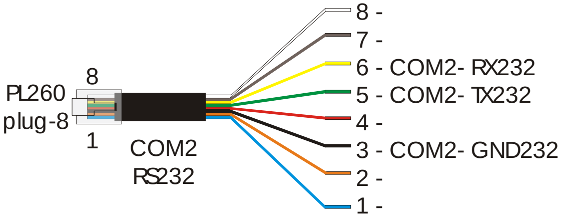
1.5 Electrical wiring

1.5.1 Connectors and terminal blocks

N°	Name	Description		
1	**+**	Power-supply 12÷24V DC 6VA. To improve noise immunity, the use of a dedicated supply is recommended.		
2	**-**			
3	**AI.1**	Analogue input AI1 positive signal		
4	**AI.2**	Analogue input AI2 positive signal		
5	**AI.3**	Analogue input AI3 positive signal		
6	**AI.4**	Analogue input AI4 positive signal		
7	**AI-COM**	Common negative signal for analogue inputs		
8	**AQ.1**	Analogue output AQ1 positive signal (0÷10 VDC)		
9	**AQ.2**	Analogue output AQ2 positive signal (0÷10V DC)		
10	**AQ.3**	Analogue output AQ3 positive signal (0÷12,5 VDC)		
11	**AQ.4**	Analogue output AQ4 positive signal (0÷12,5 VDC)		
12	**AQ-COM**	Common negative signal for analogue outputs		
21	**+V**	Common positive signal for digital inputs. Connect this signal to one of the digital inputs I1÷I16, to activate inputs. Voltage available on these pins can supply sensors to connect to the analogue inputs (N.B.: on these pins the available supply is Vcc, not stabilized!).		
45				
13	**I1 / A1**	Digital input	PL260-11AD: input for bidirectional encoder no. 1 (phase A)	To activate digital inputs, short-circuit signal +V on the input pin.
			PL260-12AD: input for fast counter no. 1	
14	**I2 / B1**	Digital input	PL260-11AD: input for bidirectional encoder no. 1 (phase B)	
			PL260-12AD: input for fast counter no. 2	

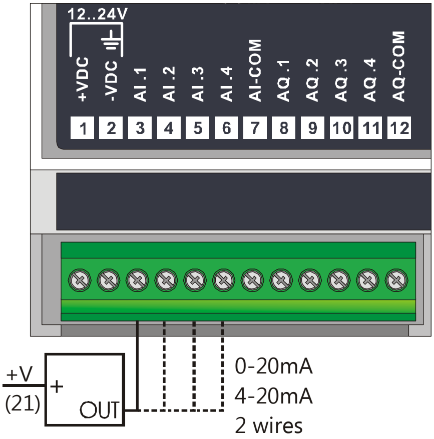
N°	Name	Description		
15	**I3 / Z1 / A2**	Digital input	PL260-11AD: input for bidirectional encoder no. 1 signal Zero, or input for bidirectional encoder no. 2 phase A. PL260-12AD: input for fast counter no. 5	To activate digital inputs, switch terminal +V to the input terminal.
16	**I4 / B2**	Digital input	Input for bidirectional encoder no. 2 (phase B)	
17	**I5**	Digital input		To activate digital inputs, switch terminal +V to the input terminal.
18	**I6**	Digital input		
19	**I7**	Digital input		
20	**I8**	Digital input		
37	**I9**	Digital input		
38	**I10**	Digital input		
39	**I11**	Digital input		
40	**I12**	Digital input		
41	**I13**	Digital input		
42	**I14**	Digital input		
43	**I15**	Digital input	PL260-12AD: input for fast counter no. 3	
44	**I16**	Digital input	PL260-12AD: input for fast counter no. 4	
22	**Q1**	Static output		Output 24Vdc - 0,7A max. Each output can produce 0,7A for a max. combined consumption of 4.0A.
23	**Q2**	Static output		
24	**Q3**	Static output		
25	**Q4**	Static output		
26	**Q5**	Static output		
27	**Q6**	Static output		
28	**Q7**	Static output		
29	**Q8**	Static output		
46	**Q9**	Static output		
47	**Q10**	Static output		
48	**Q11**	Static output		
49	**Q12**	Static output		
50	**Q13**	Static output		
51	**Q14**	Static output		
52	**Q15**	Static output		

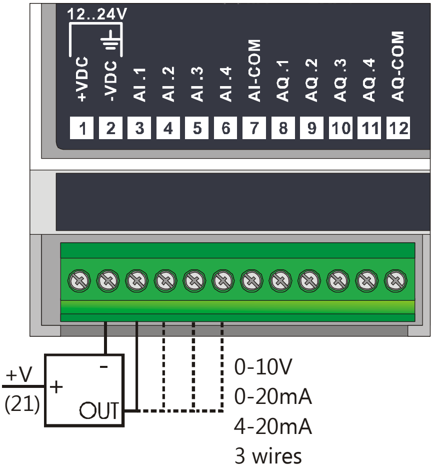
N°	Name	Description	
53	Q16	Static output	
30	+VDC	Static outputs power-supply.	Connect 12÷24 VDC
54			
31	B	Signal RS+	COM1 interface RS485
32	A	Signal RS-	
33	C	Signal RS REF	
34	CANH/RX	Signal CAN+ or RX (RS232)	EXP1 interface CAN or RS232
35	CANL/TX	Signal CAN- or TX (RS232)	
36	GND	Ref. signal for serial EXP1	

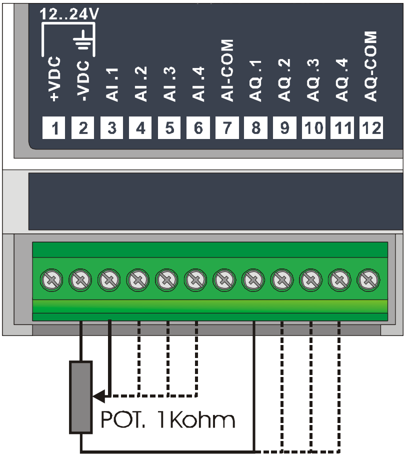
N°	Name	Description
PLUG RJ45	COM1 RS485	 PL260 plug-8 8 1 COM1 RS485 8 - 7 - 6 - 5 - 4 - COM1-A RS- (MORS 32) 3 - 2 - COM1-C RS REF (MORS 33) 1 - COM1-B RS+ (MORS 31)
	COM2 RS232	 PL260 plug-8 8 1 COM2 RS232 8 - 7 - 6 - COM2- RX232 5 - COM2- TX232 4 - 3 - COM2- GND232 2 - 1 -

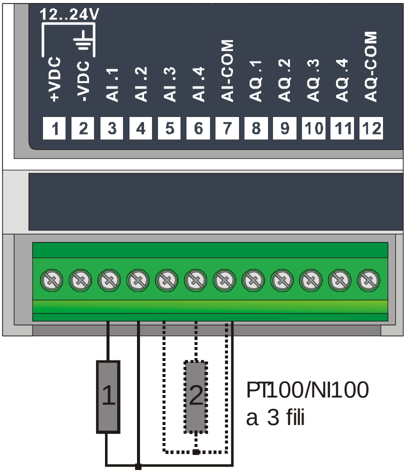
1.5.2 Connection of sensors to analogue inputs

Below some examples of connection for common sensors to the analogue inputs of the PL260.



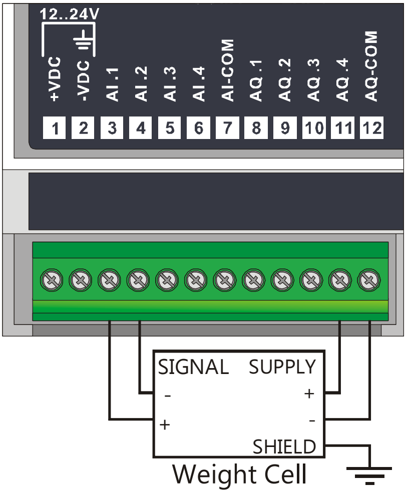






1.5.3 Connection of a load cell

Below some examples of connection for a load cell to the analogue inputs of PL260.

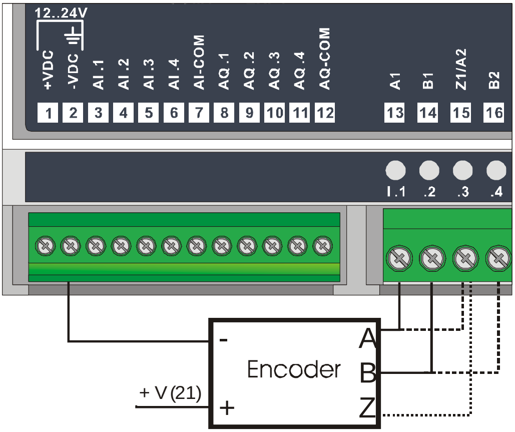


As showed in the figure, to connect a load cell to the PL260 it is necessary to:

- Create the voltage (max 5 Vdc) to supply the cell through the analogue output AQ4.
- Connect the load cell signals + and – to the analogue inputs AI1 (signal +) and AI2 (signal -) for reading the differential voltage generated.
- Configure the reference to convert input AI1 on AI2 (SM82 = 2).
- Configure analogue input AI1 on 0..20 mV (SM40 = 4).

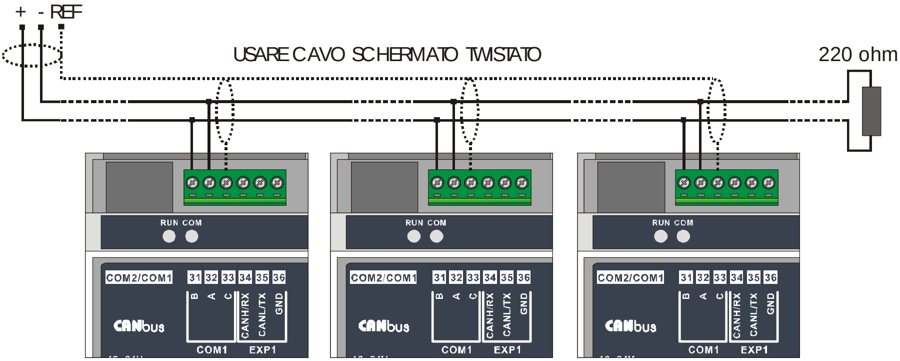
1.5.4 Connection of a bidirectional encoder

Below an example of connection for a typical bidirectional encoder (phase A,B and Z optional) which can be connected to the PL260 inputs.



1.5.5 Connect PL260 to RS485

Below an example of connection for more modules PL260 to RS485 line for the communication with a master device.



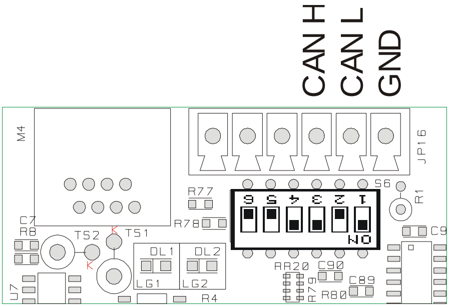
1.6 Setting dip-switch

PL260 is provided with internal dipswitches, which allow the user to configure the analogue inputs, to select the serial interface EXP1 to be connected to terminals, to select the device address and other plc functions.
WARNING: All hardware configuration procedures must be done with PL260 switched off.

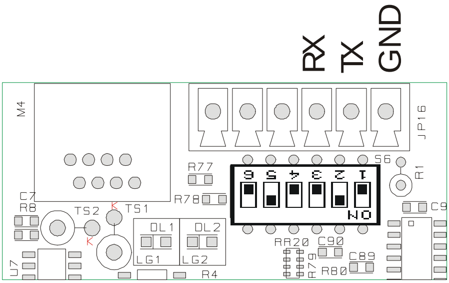
1.6.1 Setting dip-switch to select EXP1 interface

Pins 34, 35 and 36 can have a double function which can be selected through dip-switch S6, found under the 6 way terminal block and accessible without removing the cover of the box. To enable the required serial EXP1 interface, select the dipswitch as indicated in the figure:

- Serial EXP1 with CAN-bus interface for I/O expansion modules

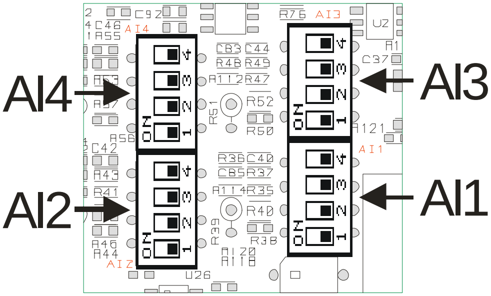


- Serial EXP1 with RS232.

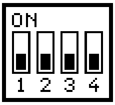
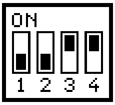
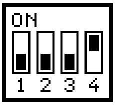
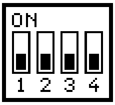


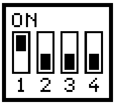
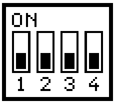
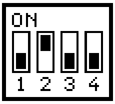
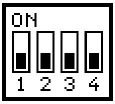
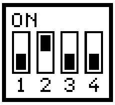
1.6.2 Setting dip-switch to select analogue input AI1..4

Each analogue input can be configured through a 4 way dip-switch, the correspondence between the inputs and the relative dip-switch is showed in the figure below:



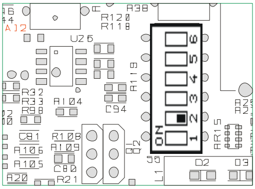
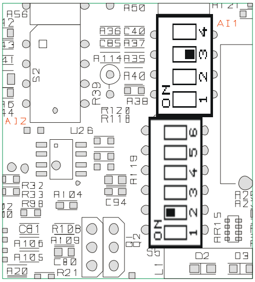
To obtain the required input type, it is necessary to set the relative dip-switch as indicated in the table below:

Input type	Dip-switch	Notes
Disabled		If the analogue input is not used, leave all switches off as showed in the figure.
0..10V 10 bit		Connect the positive signal to the analogue input, and the reference signal to the pin AI-COM.
0..10V 16 bit		Connect the positive signal to the analogue input, and the reference signal to the pin AI-COM.
0..1V **0..20 mV**		Connect the positive signal to the analogue input, and the reference signal to the pin AI-COM.

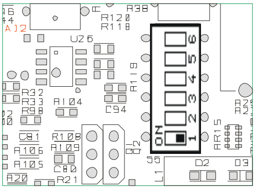
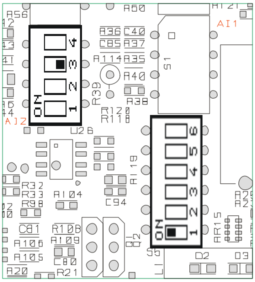
Input type	Dip-switch	Notes
0..20 mA		Connect the positive signal to the analogue input and the eventual reference pin to the power-supply digital ground (pin 2).
4..20 mA		
TC **K, S, T, R, J, E**		Connect the thermocouple positive signal to the analogue input, and the negative to the AI-COM pin.
PT100 **NI100**		**If 2 wires PT100/NI100 are used, this setting can be selected for all the inputs.** Connect one of the two wires to the analogue input and the other to the AI-COM inputs reference pin. **If 3 wires PT100/NI100 are used, this setting can be selected only for AI1 and AI4.** Connect the white wire to the analogue input AI1 or AI4, while the others (red) one to the AI-COM reference pin and one to the compensation input AI2 or AI3.
Compensation for PT100/NI100 3 wires		**If 3 wires PT100/NI100 are used**, **this setting can be selected only for AI2 and AI3,** as compensation for inputs AI1 and AI4.
NTC-10K **PT1000** **PT500** **PTC-1K**		Connect one of the two wires to the analogue input and the other one to the AI-COM input reference pin.

1.6.3 Setting dip-switch to select analogue intput AI5..6

Analogue inputs AI5..AI6 are generally selected (reset setting) through SMW44 and SMW45 as "Disabled". They can be configured as 0..10V 10 bit only if inputs AI1 and AI2 have not yet been selected as 0..10V 10 bit. AI5 uses part of the hardware of AI1, while AI6 uses part of the hardware of AI2. Selecting inputs AI5 and AI6 as 0..10V 10 bit through the relative dip-switch (see following figures), signal applied to input I7 is converted to analogue, the read value is deducted and assigned to AI5; the signal applied to input I8 is converted to analogue, the read value is deducted and assigned to input AI6. In this way it is possible to obtain two inputs 0..10V in addition to the 4 universal analogue inputs.
Figures below show the settings for dip-switch to configure analogue input AI5.

Input AI5	Dip-switch	Notes
Disabled		Analogue input AI5 is disabled and input I7 is used as digital input.
0..10V 10 bit	 AI1 AI2 ON 1 2 3 4 ON 1 2 3 4 5 6	Connect positive signal to digital input I7, and the reference signal to pin -VDC (2).

Figures below show the settings for dip-switch to configure analogue input AI6.

Input AI6	Dip-switch	Notes
Disabled		Analogue input AI6 is disabled and input I8 is used as digital input.
0..10V 10 bit		Connect positive signal to digital input I8, and the reference signal to pin -VDC (2).

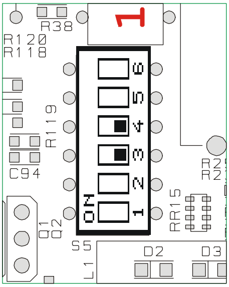
1.6.4 Setting PL260 protocol address

Two dip-switches are provided to configure the address of module for serial communication with a master device. There are 4 available combinations of these dip-switch. To connect more than 4 devices to the same network it is necessary to change the address offset value.

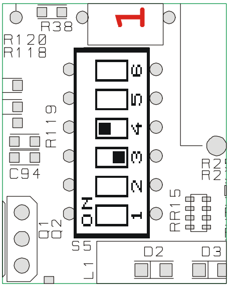
The address is given as follows:

MODULE ADDRESS = ADDRESS OFFSET + DIP-SWITCH COMBINATION

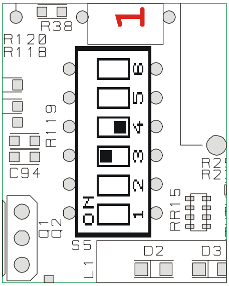
The offset address, value stored on PL260 memory (default "1"), can be modified by writing on SMW4 word.
Dip-switch combinations are:



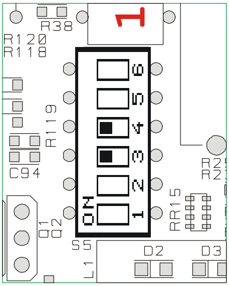
Dip-switch combination = 0



Dip-switch combination = 1



Dip-switch combination = 2



Dip-switch combination = 3

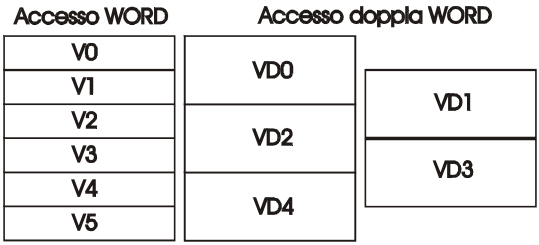
1.7 PL260 memory areas

The PL260 module provides the user with memory areas where it is possible to read or write program data. Memory areas can be entered by instruction with access by single bit (B), by word (W) or double word (D).

CODE	AREA	ACCESS
V	Variables V area	B, W, D
SM	Special Marker area	B, W, D
I	Digital inputs area	B, W
AI	Analogue inputs area	B, W
Q	Digital outputs area	B, W
M	Marker area	B, W
AQ	Analogue outputs area	B, W
T	Timer area	B, W
PT	Preset Timer area	B, W
C	Counters area	B, W
PV	Preset counters area	B, W
EEP	EEPROM area	W
MMC	EEPROM_MEMORY area	W
COM1_TX	COM1_TX area	W
COM1_RX	COM1_RX area	W
EXP1_TX	EXP1_TX area	W
EXP1_RX	EXP1_RX area	W
COM2_TX	COM2_TX area	W
COM2_RX	COM2_RX area	W

1.7.1 Variables V memory area

The memory area “Variables V” is the memory which is used by the program to store data of operations. It is composed by 350 locations, type word (16 bit) or 175 double words (32 bit). This area may be edited by operations on bit, word or double word. The number of double word still refers to the words structure, therefore a single double word uses 2 single word addresses (eg. VD0=VW0+VW1)



The values are stored also in case of power failure thanks to a rechargeable back-up battery. After charging, the battery stores data for approx. 6 months

1.7.2 Memory area “special marker SM”

This area is the memory which contains all data used by the ladder program to interact with the hardware resources of PL260. Some of this data is initialized when starting the PLC with the default values described in the table below. This area contains all data related to analogue inputs, trimmers, counts and set values of encoders, and also some bits controlled by the PLC for the ladder application as well as the settings for serial ports.
The table below includes the content of each single location of the area “Special markers”, giving the address for Modbus protocol and the type of operation allowed for each location (R=reading, W=writing, R/W=reading/writing).

SM n°	Mod. word	Description / meaning		
SM0	**1000**	**Status bit**		
		Bit 0	RUN/STOP bit (1=run). At starting this bit is always forced to ON, obtaining the RUN mode of PLC. In STOP mode, the relay outputs of PLC are disabled.	R/W
		Bit 1	This bit is always ON for first scanning cycle of main program. Eg. It is used to execute initialization subprogram.	R
		Bit 2	This bit makes available a clock impulse of 60 seconds (ON for 30 seconds, OFF for 30 seconds).	R
		Bit 3	This bit makes available a clock impulse of 1 second (ON for 0,5 second, OFF for 0,5 second)	R
		Bit 4	This bit is a clock of scanning cycle, which is active ON for one cycle and disabled OFF for following cycle. It may be used as counting input for scanning cycle.	R
		Bit 5	Bit TEST. Setting this bit as ON, the reading of digital inputs is disabled. Status of inputs is read on word SM37. Setting this word, it is possible to execute debug/test of the program simulating input starting.	R/W
		Bit 6	This bit is ON during the transmission of data to serial port COM1. It is automatically set to OFF at the end of transmission	R
		Bit 7	This bit is ON during the transmission of data to serial port EXP1. It is automatically set to OFF at the end of transmission.	R
		Bit 8	This bit is ON during the transmission of data to serial port COM2. It is automatically set to OFF at the end of transmission.	R
		Bit 9	If set to ON this bit enables mode “modem” for serial port COM1. This means that Timeout between one character and the other character in receiving mode is automatically set to 40mS.	R/W

Bit 10	If set to ON this bit enables mode “modem” for serial port EXP1. This means that Timeout between one character and the other character in receiving mode is automatically set to 40mS.	R/W
Bit 11	If set to ON this bit enables mode “modem” for serial port COM2. This means that Timeout between one character and the other character in receiving mode is automatically set to 40mS.	R/W
Bit 12	If set to 1, this bit disables internal clock reading/writing, making faster program execution.	R/W
Bit 13	If set to 1, this bit disables counters C[1..16] and enables timers T[49..64], normally disabled.	R/W

SM1	**1001**	**Diagnostic Bit (faults/anomalies)**		
		Bit 0	This bit is ON if the retaining data of the area “special marker” are lost.	R/W
		Bit 1	This bit is ON if the retaining data of the “marker” area are lost.	R/W
		Bit 2	This bit is ON if the retaining data of EEProm area are lost.	R/W
		Bit 3	This bit is ON if calibration data are lost.	R/W
		Bit 4	This bit is ON if the CPU has been reset or if there is a watchdog intervention.	R/W
		Bit 5	This bit is ON if there is stack overflow on the ram reserved area.	R/W
		Bit 6	This bit is ON if an error has occurred during the calibration process.	R/W
		Bit 7	This bit is ON if there is an error/fault of serial EEprom.	R/W
		Bit 8	This bit is ON if there is an error/fault of serial clock.	R/W
		Bit 9	This bit is ON if there is an error/fault of the 16 bit digital analogue converter.	R/W
		Bit 10	This bit is ON if there is a stack overflow of timed interrupts.	R/W

		Bit 12	This bit is ON if the analogue AI1 input is out of range.	R
		Bit 13	This bit is ON if the analogue AI2 input is out of range.	R
		Bit 14	This bit is ON if the analogue AI3 input is out of range.	R
		Bit 15	This bit is ON if the analogue AI4 input is out of range.	R

SM2	**1002**	**Bit for management of bidirectional encoders / step motor**		
		Bit 0	Loading of counter for bidirectional encoder 1. Setting this bit to “1”, at the end of scanning cycle, the counter of encoder1 (32 bit) is loaded with the value of SMD24. The bit is automatically set to OFF at the end of operation.	R/W
		Bit 1	Loading of counter for bidirectional encoder 2. Setting this bit to “1”, at the end of scanning cycle, the counter of encoder 2 (32 bit) is loaded with the value of SMD26. The bit is automatically set to OFF at the end of operation.	R/W
		Bit 2	Loading counter of bidirectional encoder 1 with zero impulse. Setting this bit to “1”, at the next zero impulse of encoder 1 (connected to input I3), the counter of encoder1 (32 bit) is loaded with the value of SMD24. The bit is automatically set to OFF at the end of operation.	R/W
		Bit 3	Not used	-
		Bit 4	This bit, if set to "1" on "INITIALIZATION CODE" of program ladder, enables the management of a step motor. **N.B.: If step motor is enabled, timed interrupt no. 1 is no longer active.**	R/W
		Bit 5	This bit, if set to "1" (only if SM2.4 = 1), enables output AQ1 to manage step motor.	R/W

Bit 6	This bit, if set to "1" (only if SM2.4 = 1 and SM2.5 = 1), creates on output AQ1 a series of impulses 0-5V and frequency equal to the one selected on SM16 (step motor final frequency). The final frequency is reached after an acceleration ramp whose duration (in ms) is specified by SM18.	R/W
Bit 7	Not used	-
Bit 8	**Only for PL260-12AD** Loading counter of bidirectional encoder 3. Setting this bit to "1", at the end of scanning cycle, the counter of encoder3 (32 bit) is loaded with the value of SMD136. The bit is changed in OFF at the end of the operation.	R/W
Bit 9	**Only for PL260-12AD** Loading counter of bidirectional encoder 4. Setting this bit to “1”, at the end of scanning cycle, the counter of encoder4 (32 bit) is loaded with the value of SMD138. The bit is changed in OFF at the end of the operation.	R/W
Bit 10	**Only for PL260-12AD** Loading counter of bidirectional encoder 5. Setting this bit to “1, at the end of scanning cycle, the counter of encoder5 (32 bit) is loaded with the value of SMD140. The bit is changed in OFF at the end of the operation.	R/W

SM4	**1004**	**PL260 protocol address offset**		
			This word contains the PL260 protocol address offset. Its value is added to the one obtained combining the selection dipswitch addresses (see paragraph 1.6.3). At start it is fixed to 1.	R/W
SM5	**1005**	**Status of selection dip**		
			This word indicates the position of the selection dipswitch. If the dipswitch is closed, the correspondent bit will be automatically set to "1", instead (if opened) it will be set to "0".	R
		Bit 0	This bit shows the status of dipswitch S5-4 for protocol address selection.	R
		Bit 1	This bit shows the status of dipswitch S5-3 for protocol address selection.	R
		Bit 2	This bit shows the status of dipswitch S5-5.	R

SM6	**1006**	**Cycle time**	
		This word gives the time of the program last scanning cycle (resolution 100 µS).	R
SM7	**1007**	**Min. cycle time**	
		This word gives the min. time of the program last scanning cycle (resolution 100 µS).	R
SM8	**1008**	**Max. cycle time**	
		This word gives the max. time of the program last scanning cycle (resolution 100 µS).	R

SM9	**1009**	**Internal clock seconds (0..59)**	
SM10	**1010**	**Internal clock minutes (0..59)**	
SM11	**1011**	**Internal clock hours (0..23)**	
SM12	**1012**	**Internal clock day (1..31)**	
SM13	**1013**	**Internal clock month (1..12)**	
SM14	**1014**	**Internal clock year (0..99)**	
SM15	**1015**	**Internal clock day of the week (0..6)** (0→Sunday, 1→Monday, … 6→Saturday)	
		These words contain the date and time of the internal clock. Writing on each of these words updates the internal clock. An internal battery allows the clock to function during a power failure.	R/W
SM16	**1016**	**Interval of timed interrupt no. 1 (default 100 ms)**	
SM17	**1017**	**Interval of timed interrupt no. 2 (default 100 ms)**	
		These words define the interval for timed interrupts. Value of interval may be set between 1 and 100 ms (example: SM16=1 → 1 ms SM16=100 → 100 ms). For SM16 and SM17 values not included between 1 and 100, the default setting of relevant interrupt is 100 ms. At starting the values are fixed as 100 → 100 ms. On the interrupts ladder programs it is not allowed to use functions which access EEPROM and MMC areas.	R/W

SM20	**1020**	**Counts of bidirectional counter encoder 1 (high area)**	
SM21	**1021**	**Counts of bidirectional counter encoder 1 (low area)**	
SM22	**1022**	**Counts of bidirectional counter encoder 2 (high area)**	
SM23	**1023**	**Counts of bidirectional counter encoder 2 (low area)**	
		Only for PL260-11AD These two pairs of words contain the value of bidirectional counters for encoders 1 and 2. Counting is stored also if there is a power failure and it is automatically updated at each program scanning. **Only for PL260-12AD** These two pairs of words contain the value of bidirectional fast counters for encoders 1 and 2. Counting is stored also if there is a power failure and it is automatically updated at each program scanning.	R
SM24	**1024**	**Loading value for counter of encoder 1 (high area)**	
SM25	**1025**	**Loading value for counter of encoder 1 (low area)**	
		These words contain the value (in counts) which is loaded on the counter of encoder 1 when the loading bit SM2.0 is set to "1".	R/W
SM26	**1026**	**Loading value for counter of encoder 2 (high area)**	
SM27	**1027**	**Loading value for counter of encoder 2 (low area)**	
		These words contain the value (in counts) which is loaded on the counter of encoder 2 when the loading bit SM2.1 is set to "1".	R/W
SM28	**1028**	**Counts per second of encoder 1**	
SM29	**1029**	**Counts per second of encoder 2**	
		These words contain the number of counts completed by the encoders during the last second. These words are automatically updated at each second.	R
SM30	**1030**	**Counts per tenth of second for encoder 1**	
SM31	**1031**	**Counts per tenth of second for encoder 2**	
		These words contain the number of counts completed by the encoders during the last 100 ms. These words are automatically updated at each 100 ms.	R

SM32	1032	**Counting increment for fast counter no. 1**	
SM33	1033	**Counting increment for fast counter no. 2**	
SM34	1034	**Counting increment for fast counter no. 3**	
SM35	1035	**Counting increment for fast counter no. 4**	
SM36	1036	**Counting increment for fast counter no. 5**	
		Only for PL260-12AD These words contains the number of counts which are added to the relative counter when there is a rising or falling transition of the counter counting input (I1, I2, I15, I16 e I3).	R
SM37	1037	**Status of digital inputs I1÷I16 for test procedure**	
		This word defines the status for digital inputs during test procedure (SM0.5=1). Each bit of this word corresponds to the status of a digital input, starting from the bit less significant (SM37.0→I1, SM37.15→I16). This word is zeroed automatically at each starting.	R/W
SM38	1038	**Digital inputs filter (default 10 ms)**	
		It is possible to filter the signals of digital inputs selecting a delay time. If the input status changes, the new status will be accepted only if it is stored by the input for the selected time. Data will be accepted only when the filter will have cancelled noises and fixed inputs lines on stable values. PL260 supports filters with delay time between 0 and 50 ms.	R/W

SM39	1039	**Analogue input filter (default 5 means)**		
		A filter may be applied to the signals of analogue inputs, selecting the number of values to consider in the average for the rating of final input value/ to exclude software filter (means) for each input/ to exclude control function which automatically rejects wrong conversions.		R/W
		Bit 0÷3	These bits select the number of values to consider in the average to calculate input value. 1..5 → number of conversions considered in the average.	R/W
		Bit 4	Input AI1 software filter exclusion. 0 → filter enabled 1 → filter excluded	R/W
		Bit 5	Input AI2 software filter exclusion. 0 → filter enabled 1 → filter excluded	R/W
		Bit 6	Input AI3software filter exclusion. 0 → filter enabled 1 → filter excluded	R/W
		Bit 7	Input AI4 software filter exclusion. 0 → filter enabled 1 → filter excluded	R/W
		Bit 8	Input AI5 software filter exclusion. 0 → filter enabled 1 → filter excluded	R/W
		Bit 9	Input AI6 software filter eclusion. 0 → filter enabled 1 → filter excluded	R/W
		Bit 10	AI1 false conversions discard. 0 → discard enabled 1 → discard disabled	R/W
		Bit 11	AI2 false conversions discard. 0 → discard enabled 1 → discard disabled	R/W
		Bit 12	AI3 false conversions discard. 0 → discard enabled 1 → discard disabled	R/W
		Bit 13	AI4 false conversions discard. 0 → discard enabled 1 → discard disabled	R/W
		Bit 14	AI5 false conversions discard. 0 → discard enabled 1 → discard disabled	R/W
		Bit 15	AI6 false conversions discard. 0 → discard enabled 1 → discard disabled	R/W

SM40	**1040**	**Analogue input AI1 configuration**	
SM41	**1041**	**Analogue input AI2 configuration**	
SM42	**1042**	**Analogue input AI3 configuration**	
SM43	**1043**	**Analogue input AI4 configuration**	
SM44	**1044**	**Analogue input AI5 configuration** [3]	
SM45	**1044**	**Analogue input AI6 configuration** [4]	
		These special marker words define the type of sensor connected to analogue inputs AI1...AI6 (select the jumpers correctly to configure the inputs). At starting these words are automatically selected as input 0..10V-10bit, AI5...AI6 as not enabled inputs. 0 → Input disabled 1 → Input 0÷10V (resolution 10 bit) 2 → Input 0÷10V (resolution 16 bit) 3 → Input 0÷1V 4 → Input 0÷20mV 5 → Input 0÷20mA 6 → Input 4÷20mA 7 → Input thermocouple type K 8 → Input thermocouple type S 9 → Input thermocouple type T 10 → Input thermocouple type R 11 → Input thermocouple type J 12 → Input thermocouple type E 13 → Not available 14 → Input PT100 15 → Input NI100 16 → Input compensation PT100/NI100 (only for PT100/NI100 3 wires. Selection allowed only for AI2 and AI3, respectively compensation for AI1 and AI4) 17 → Not available 18 → Input NTC-10K β=3435 19 → Input conversion counts 20 → Input PT1000 21 → Input PT500 22 → Input PTC-1K	R/W

[3] See par. "Setting dip-switch to select analogue intput AI5..6"

[4] See par. "Setting dip-switch to select analogue intput AI5..6"

SM46	**1046**	**Min. value for Analogue input AI1 linear**	
SM47	**1047**	**Min. value for Analogue input AI2 linear**	
SM48	**1048**	**Min. value for Analogue input AI3 linear**	
SM49	**1049**	**Min. value for Analogue input AI4 linear**	
SM50	**1050**	**Min. value for Analogue input AI5 linear**	
SM51	**1051**	**Min. value for Analogue input AI6 linear**	
SM52	**1052**	**Max. value for Analogue input AI1 linear**	
SM53	**1053**	**Max. value for Analogue input AI2 linear**	
SM54	**1054**	**Max. value for Analogue input AI3 linear**	
SM55	**1055**	**Max. value for Analogue input AI4 linear**	
SM56	**1056**	**Max. value for Analogue input AI5 linear**	
SM57	**1057**	**Max. value for Analogue input AI6 linear**	
		Select min. and max. numeric limits for the analogue conversion of inputs AI configured as V/I (current and tension). These words are modified using the instruction RANGE(AIx,Min,Max). Default settings are 0 for min. value and 1000 for max. value.	R/W
SM58	**1058**	**Offset calibration Analogue input AI1**	
SM59	**1059**	**Offset calibration Analogue input AI2**	
SM60	**1060**	**Offset calibration Analogue input AI3**	
SM61	**1061**	**Offset calibration Analogue input AI4**	
SM62	**1062**	**Offset calibration Analogue input AI5**	
SM63	**1063**	**Offset calibration Analogue input AI6**	
SM64	**1064**	**Gain calibration Analogue input AI1**	
SM65	**1065**	**Gain calibration Analogue input AI2**	
SM66	**1066**	**Gain calibration Analogue input AI3**	
SM67	**1067**	**Gain calibration Analogue input AI4**	
SM68	**1068**	**Gain calibration Analogue input AI5**	
SM69	**1069**	**Gain calibration Analogue input AI6**	
		These words define the calibration of conversion for AI1..AI6. They are used to correct possible errors of reading. The formule is as follows: Value AIx = Value AIx + (Value AIx * Gain calibration AIx) / 1000 Offset calibration AIx. At starting all calibration values are set to zero.	R/W

SM73	1073	**Min. value for analogue output AQ1**	
SM74	1074	**Min. value for analogue output AQ2**	
SM75	1075	**Min. value for analogue output AQ3**	
SM76	1076	**Min. value for analogue output AQ4**	
		These words define the value of the software analogue output AQx which corresponds to 0V on the physical output. These words are modified using the instruction RANGE(AQx,Min,Max). At starting they are selected to 0.	
SM77	1077	**Max. value for analogue output AQ1**	
SM78	1078	**Max. value for analogue output AQ2**	
SM79	1079	**Max. value for analogue output AQ3**	
SM80	1080	**Max. value for analogue output AQ4**	
		These words define the value of the software analogue output AQx which corresponds to 10V on the physical output. These words are modified using the instruction RANGE(AQx, Min, Max). At starting they are selected to 100.	R/W
SM81	1081	**Frequency of digital analogue converter (default 55 Hz)**	
		Defines the conversion frequency in Hz for the digital analogue converter. Through this parameter it is possible to change the conversion speed to obtain a faster or more stable conversion, according to the requirements. Allowed frequency value changes from 18 Hz (conversion slower and more precise) to 1920 Hz (conversion faster but less precise).	R/W
SM82	1082	**Input AI1 conversion reference (default 0)**	
SM83	1083	**Input AI2 conversion reference (default 0)**	
SM84	1084	**Input AI3 conversion reference (default 0)**	
SM85	1085	**Input AI4 conversion reference (default 0)**	
		Defines the reference used by the digital analogue converter to convert the analogue inputs AI. Through these special markers, it is possible to change the default reference (0 = AI-COM) moving it from the analogue ground to one of the other analogue inputs, realizing a differential reading between two AI inputs. Allowed settings are: 0 → AI-COM 1 → AI1 3 → AI3 2 → AI2 4 → AI4	R/W

SM86	**1086**	**SETUP register for converter A/D (default 10)**		
		This special marker allows to change some settings of the internal digital analogue converter. This register is managed by bit, and not all of them can be modified.		R/W
		Bit 7÷5	Not used, keep it to “0”	
		Bit 4	Conversion speed divisor: 0 → normal conversion speed 1 → halved conversion speed	
		Bit 3	Not used, keep it to “1”	
		Bit 2	VREF converter voltage reference 0 → internal reference 1,25 V 1 → internal reference 2,50 V	
		Bit 1	Converter input buffer 0→ disabled buffer 1→ enabled buffer	
		Bit 0	Not used, keep it to “0”	

SM87	**1087**	**Register MDEC1 converter A/D (default 64)**		
		This special marker allows to change some settings of the internal digital analogue converter. This register is managed by bit, and not all of them can be modified.		R/W
		Bit 7	Not used, keep it to “0”	
		Bit 6	Conversion format 0 → bipolar 1 → unipolar	
		Bit 5÷4	Converter internal filter 00 → Auto 01 → Fast 10 → Sinc2 11 → Sinc3	
		Bit 3÷0	Not used, keep it to “0”	
SM88	**1088**	**Register GAIN converter A/D (default 0)**		
		This special marker allows to change the converter input amplifier gain (PGA). Value selected into this register is valid only for analogue inputs configured in counts (SM40..43 = 19). This register is managed by bit, and not all of them can be modified.		R/W
		Bit 7÷3	Not used, keep it to “0”	
		Bit 2÷0	Input amplifier gain “PGA” 000 → 1 100 → 16 001 → 2 101 → 32 010 → 4 110 → 64 011 → 8 111 → 128	
SM89	**1089**	Register OFFSET converter A/D (default 0)		
		This special marker allows to select an offset value for the input of the internal digital analogue converter. Value selected into this register is valid only for analogue inputs configured in counts (SM40..43 = 19). This register is managed by bit, and not all of them can be modified.		R/W
		Bit 7	Input offset value sign 0 → Positive offset 1 → Negative offset	
		Bit 6÷0	Input offset value Offset (Volt) = (**V**REF * Valore Offset) / (254 * **PGA**)	

SM96	**1096**	**Baudrate canbus EXP1 (default 1 Mbit/s)**	
		Value selected into this word defines the port EXP1 communication speed in EXP-I/O-CANBUS mode. 0 → 50 Kbit/s 1 → 62,5 Kbit/s 2 → 100 Kbit/s 3 → 125 Kbit/s 4 → 250 Kbit/s 5 → 500 Kbit/s 6 → 1 Mbit/s	R/W
SM97	**1097**	**Interval for NMT control data transmission to CAN expansion modules (default 500 * 0,2ms = 100 ms)**	
		Value selected for this word defines the min. interval time (resolution 0,2 ms) between two consecutive transfer of control characters from the PL260 to the expansion modules, to determinate the correct functioning (range 500...5000).	R/W
SM98	**1098**	**Interval for data transmission to CAN expansion modules (default 5 * 0,2ms = 1,0 ms)**	
		Value selected for this word defines the min. interval time (resolution 0,2 ms) between two consecutive outputs updates from the PL260 to the expansion modules mapped on the EXP1 port in EXP-I/O-CANBUS mode (range 5...5000).	R/W

SM99	**1099**	**Can modules management flag (default 0)**		
		Bit 0	This bit defines if the PL260 transmits data to the expansion devices only at regular intervals (defined by SM98) or also at each variation of them. 0 → OFF data transmission only at time 1 → ON data transmission on variation and at time	R/W
		Bit 1	This bit defines if bus for transmission of CAN packets to slave modules is free and if it is possible to a new reading/writing instruction/request to the slave. Bit is automatically set to "1" at request and it is set to "0" when the request is executed. 0 → bus free 1 → bus busy	R/W
		Bit 2	This bit shows if an answer has been received after a PL260 query to the generic CAN. It is automatically reset to zero at each command or request of data reading/writing. 0 → waiting answer 1 → answer arrived	R/W
		Bit 3	This bit shows if a wrong answer has been received after a PL260 query to the generic CAN slave. It is automatically reset to zero at each command or request of data reading/writing. 0 → correct answer 1 → wrong answer	R/W
		Bit 4	This bit defines if after a NMT command of the PL260 to a CAN slave module, it will answer with a status other than "operational". This bit defines if a reconfiguration/start-up proceeding is necessary for the CAN module. It is automatically reset to zero at each NMT command. 0 → slave in “operational” 1 → slave not in “operational”	R/W

SM100	1100	**Serial COM1 status**	
SM110	1110	**Serial EXP1 status**	
SM120	1120	**Serial COM2 status**	
		These words define the status of communication serials COM1, EXP1 and COM2. Each bit of each word signals a condition of missing communication (off-line) or an error for each transmitted/received data by instructions COM_1÷16 or EXP_1÷16 (ex. SM100.0=1 shows the error on COM_1(...) instruction). If serial is selected on slave protocol, the error condition is signaled setting to "1" all bits of correspondent word whenever no correct packet with slave address same as the device is not received within the time fixed on SM105, SM115 and SM125. If serial EXP1 is selected as “EXP-I/O-CANBUS”, each bit of word SM110 corresponds to status of each expansion module of I/O. Specifically bit 0 defines the status of module mapped by instruction MapEXP1 (0=module online, 1= module off-line), bit 1 defines the status of module mapped by instruction MapEXP2 and so on.	R

SM101	1101	**Serial baudrate COM1 (default 9600 baud)**	
SM111	1111	**Serial/canbus baudrate EXP1 (default 9600 baud)**	
SM121	1121	**Serial baudrate COM2 (default 19200 baud)**	
		Value selected into this word defines the serial port communication speed[5]. 0 → 110 baud 1 → 150 baud 2 → 300 baud 3 → 600 baud 4 → 1200 baud 5 → 2400 baud 6 → 4800 baud 7 → 9600 baud 8 → 19200 baud 9 → 28800 baud 10 → 38400 baud 11 → 57600 baud	R/W
		Value selected into this word defines port EXP1 communication speed in EXP-I/O-CANBUS mode: 0 → 110 baud 1 → 150 baud 2 → 300 baud 3 → 600 baud 4 → 4800 baud 5 → 9600 baud 6 → 19200 baud 7 → 28800 baud	
SM102	1102	**Serial COM1 format**	
SM112	1112	**Serial EXP1 format**	
SM122	1122	**Serial COM2 [6] format**	
		Value selected into this word defines the serial port communication data[7]. 0 → 8,N,1 (default) 1 → 8,O,1 2 → 8,E,1 3 → 7,N,1 4 → 7,O,1 5 → 7,E,1 6 → 8,N,2 7 → 8,O,2 8 → 8,E,2 9 → 7,N,2 10 → 7,O,2 11 → 7,E,2	R/W

[5] To enable modifications it is necessary to set this word within initialization function. If no modification has been completed or if it has been done in other sections of the program, baud-rate will be kept as default at starting.

[6] Format may not be modified (8,N,1).

[7] To enable modifications it is necessary to set this word within initialization function. If no modification has been completed or if it has been done in other sections of the program, baud-rate will be kept as default at starting.

SM103	1103	**Delay answer/wait incoming data COM1 (def.20ms)**	
SM113	1113	**Delay answer/wait incoming data EXP1 (def. 20ms)**	
SM123	1123	**Delay answer/wait incoming data COM2 (def. 0ms)**	
		With slave protocol this word defines min. delay between end of data receiving from master device and the start of answer transmission form PL260 (max. 100ms). With master protocol this word define max. waiting between start of query transmission from PL260 and full receiving of answer from slave device. Value is expressed in ms.	R/W
SM104	1104	**Delay new master transmission COM1 (default 5 ms)**	
SM114	1114	**Delay new master transmission EXP1 (default 5 ms)**	
SM124	1124	**Delay new master transmission COM2 (default 5 ms)**	
		With master protocol this word defines min. waiting between end of data receiving (from slave to master), and start of transmission for a new query from master to slave. With slave protocol this value is not used. Value is expressed in ms, range 0-100 ms.	R/W
SM105	1105	**Number of errors for signal on status COM1 (def. 10)**	
SM115	1115	**Number of errors for signal on status EXP1 (def. 10)**	
SM125	1125	**Number of errors for signal on status COM2 (def. 10)**	
		Value entered for this word defines: **If master protocol** - the number of consecutive communication errors after which the anomaly is notified in the relevant bit of “serial status”. **If slave protocol** - the time in seconds after that the anomaly is notified keeping to "1" all bit of the word "serial status".	R/W

SM108	**1108**	**COM1 configuration in free-port mode**		
SM118	**1118**	**EXP1 configuration in free-port mode**		
SM128	**1128**	**COM2 configuration in free-port mode**		
		These words enable functioning of serial port in free-port mode, selecting also functioning parameters. Enabling this mode, communication protocol which uses the serial is disabled and so it is possible to access directly the transmission/reception of data on port. These parameters, at switch on, are selected to 0 (free-port mode disabled).		R/W
		Bit 0÷3	These bit select communication speed for the serial port in free-port mode, according to this values: 0 → 110 baud 1 → 150 baud 2 → 300 baud 3 → 600 baud 4 → 1200 baud 5 → 2400 baud 6 → 4800 baud 7 → 9600 baud 8 → 19200 baud 9 → 28800 baud 10 → 38400 baud 11 → 57600 baud	R/W
		Bit 4÷7	These bits select the format for the serial port communication data in free-port mode: 0 → 8,N,1 1 → 8,O,1 2 → 8,E,1 3 → 7,N,1 4 → 7,O,1 5 → 7,E,1 6 → 8,N,2 7 → 8,O,2 8 → 8,E,2 9 → 7,N,2 10 → 7,O,2 11 → 7,E,2	R/W
		Bit 8	This bit selected to "1" enables mode free-port, if selected to "0" it keeps serial to normal mode where it is managed directly by the selected protocol into the programming phase.	R/W

SM106	1106	**Number of timeouts on COM1**	
SM116	1116	**Number of timeouts on EXP1**	
SM126	1126	**Number of timeouts on COM2**	
		These words are counters (reset at starting) which are incremented at each timeout noticed by the function for the managing of each serial port protocol.	R/W
SM107	1107	**Number of errors on COM1**	
SM117	1117	**Number of errors on EXP1**	
SM127	1127	**Number of errors on COM2**	
		These words are counters (reset at starting) which are incremented at each error (Ex. wrong checksum, wrong number of received data) noticed by the function for the managing of each serial port protocol.	R/W
SM109	1109	**Number of characters present in the reception buffer of serial COM1**	
SM119	1119	**Number of characters present in the reception buffer of serial EXP1**	
SM129	1129	**Number of characters present in the reception buffer of serial COM2**	
		These words contains for each serial, the number of valid characters present into reception buffer. The use of these words is significant on free-port mode to control number of received characters. Any writing on these words, selects value corresponding to zero, emptying reception buffer.	R/W
SM130	1130	**Counts of bidirectional counter encoder 3 (high part)**	
SM131	1131	**Counts of bidirectional counter encoder 3 (low part)**	
SM132	1132	**Counts of bidirectional counter encoder 4 (high part)**	
SM133	1133	**Counts of bidirectional counter encoder 4 (low part)**	
SM134	1134	**Counts of bidirectional counter encoder 5 (high part)**	
SM135	1135	**Counts of bidirectional counter encoder 5 (low part)**	
		Only for PL260-12AD These three pairs of words contains value of fast counters 3,4 and 5. The count is kept also in case of power failure and it is updated automatically at each program scanning.	R

SM136	1136	**Loading value for encoder 3 counter (high part)**	
SM137	1137	**Loading value for encoder 3 counter (low part)**	
		Only for PL260-12AD These two words contain value in counts which is loaded on the counter of encoder 3 when loading bit SM2.8 is selected to "1".	R/W
SM138	1138	**Loading value for encoder 4 counter (high part)**	
SM139	1139	**Loading value for encoder 4 counter (low part)**	
		Only for PL260-12AD These two words contain value in counts which is loaded on the counter of encoder 4 when loading bit SM2.9 is selected to "1".	R/W
SM140	1140	**Loading value for encoder 5 counter (high part)**	
SM141	1141	**Loading value for encoder 5 counter (low part)**	
		Only for PL260-12AD These two words contain value in counts which is loaded on the counter of encoder 5 when loading bit SM2.10 is selected to "1".	R/W
SM142	1142	**Counts at second of encoder 3**	
SM143	1143	**Counts at second of encoder 4**	
SM144	1144	**Counts at second of encoder 5**	
		Only for PL260-12AD These two words contain the number of counts made during the last second by the encoders. These words are updated automatically each second.	R
SM145	1145	**Counts at tenth/second of encoder 3**	
SM146	1146	**Counts at tenth/second of encoder 4**	
SM147	1147	**Counts at tenth/second of encoder 5**	
		Only for PL260-12AD These two words contain the number of counts noticed during the last 100 ms by the encoders. These words are automatically updated each 100 ms.	R

1.7.3 Memory area "digital inputs I"

This memory area “digital inputs I” is the area in which the state of digital inputs is stored. It is organized in words; each of the 16 bits of the word represents the state of an input. For instance: the state of digital input I20 is stored on bit no. 3 of word 2 in area I. The area consists of 4 words. The first and the second are updated with actual state of inputs at the starting of each cycle, while the last two words may contain the state of inputs read via serial communication from an expansion module.

1.7.4 Memory area "digital outputs Q"

This memory area stores status of digital outputs. It is organized in words; each of the 16 bits of the word represents the status of an output. Eg.: the status of digital output Q1 is stored on bit no. 0 of word 1 into the area Q. The area consists of 8 words. The first one is transferred to the outputs of PL260 at the end of each cycle, the other ones may contain the status of further outputs to write via serial communication to an expansion module.

1.7.5 Memory area "support marker M"

Memory area M contains the status of all markers (bit contacts) used into the program. It is organized in words; each of 16 bits of the word means the status of a marker. Eg.: status of marker M1 is stored on bit number 0 of word 1 in the area M. The area is composed of 8 words.

1.7.6 Memory area "analogue inputs AI"

Into this memory area the PL260 stores the value which is measured on the analogue inputs. This value is calculated according to min. and max. limits which have been set as the range of the analogue input.

1.7.7 Memory area "analogue outputs AQ"

Memory area “analogue outputs AQ” is the memory where values for analogue outputs are assigned. The percentage of analogue output will be calculated starting from the entered value considering the range (min and max) of analogue output.

1.7.8 Memory area "timer T"

This memory area contains timer values. If timer is enabled, the value contained into this area will increase or decrease according to the type of timer, with the resolution chosen at the starting of timer.

1.7.9 Memory area "preset timer PT"

Memory area “preset timer PT” is the memory where preset values of timers are stored.

1.7.10 Memory area "counters C"

This memory area contains counters values. Accordingly to the type of counter, at each counting operation, the value contained into this area will be updated.

1.7.11 Memory area preset values of counters PV

In this area are stored the preset values of counters PV.

1.7.12 Memory area EEPROM

EEPROM area is the non-volatile memory to store all data which cannot be lost even if PLC is switched-off for long periods (over 6 months). Data stored in this area is tested at the starting of the PLC to check its integrity and in case of anomaly, the fault condition is notified (SM1.2) and the whole area is initialized at 0 (zero). Access and writing in this area requires longer time than any other area, therefore it is recommended not to use this area for frequent access, but only at starting to copy the stored data , for example in area V , and then to use these for quick access, guaranteeing a faster program.
N.B.: EEPROM memory allows a max. number of writings for each location (warranted 1000000), after that data integrity is no longer assured; so it is necessary to avoid continuously writing into this memory area.

1.7.13 Memory area MMC

MMC area is the optional external memory which can be used to save big amounts of data which must be stored even by lack of power supply. Memory is Eeprom, therefore access to this area is slower than access to area V and SM. PL260 does not check integrity of data saved in this area.

This area is divided in words (0÷12999) and can also be entered by Modbus protocol.

N.B.: MMC memory allows a max. number of writings for each location (warranted 1000000), after that data integrity is no longer assured; so it is necessary to avoid continuously writing into this memory area.

1.7.14 Memory areas COMx_SEND and EXP1_SEND

Memory area COMx_SEND and EXP1_SEND are used to load data which will be sent to the relevant serial port. They are used only in mode free-port. In standard mode these areas are handled with the selected communication protocol.

These areas are divided in byte (8 bit).

1.7.15 Memory areas COMx_RECEIVE and EXP1_RECEIVE

Memory areas COMx_RECEIVE and EXP1_RECEIVE are used to save data received by the relevant serial port. They are used only in mode free-port. In standard mode these areas are handled with the selected communication protocol.

These areas are divided in byte (8 bit).

1.8 Modbus RTU slave communication protocol

Module PL260 is conceived for the use with SCADA systems or Operator panels via Modbus protocol RTU. Serial communication enables reading and modifying of data on available memory areas, entering and visualizing any data concerning the PLC. Module PL260 is provided with 3 serial communication ports which are enabled to operate as slaves with MODBUS protocol:

COM1 - RS485 available on connector plug-8 and on pins 31, 32 and 33.
EXP1 - RS232 available on pins 34, 35 and 36.
COM2 - RS232 available on connector plug-8.

Both serials support protocol modbus RTU as described below. Therefore the module PL260 may be connected and may communicate with 3 master devices at the same time.

Modbus RTU main features	
Baud-rate	Programmable
Format	8,N,1 (8 bit, no parity, 1 stop) (default)
Supported functions	BITS READING (0x01, 0x02) WORDS READING (max 30 word) (0x03, 0x04) SINGLE BIT WRITING (0x05) SINGLE WORD WRITING (0x06) MULTIPLE BITS WRITING (0x0F) MULTIPLE WORDS WRITING (max 30 word) (0x10)
Error codes	ILLEGAL FUNCTION CODE (0x01) ILLEGAL DATA ADDRESS (0x02) ILLEGAL DATA VALUE (0x04)
Broadcast	Simultaneous writing to all connected slaves using address 0x00 and no answer by slaves.
Polling with unknown slave address	Polling using address 0xFF, any connected slave can answer.

1.9 Addresses word/bit of PL260 for protocol Modbus RTU

The following tables give all data (word and bit) which may be entered via Modbus protocol. For all data the table gives reading/writing elements and the value assumed at starting of PL260. According to initialization value at starting, the following options are given:

1. **"ROM"** fixed value defined by program.
2. **"EEP"** value stored on Eeprom for 10years even in absence of power supply
3. **"TAMP"** value stored on Ram memory with buffer battery. These data are stored in absence of power supply for a limited time (approx. 4 months)
4. **"?"** value of these data is unknown at starting
5. **Defined value**, The value assumed at starting is the value defined in the table.

WORD			
MODBUS ADDRESS	**DESCRIPTION**	**READ/ WRITE**	**RESET VALUE**
0	Device type	R	ROM
1	PL260 program software version	R	ROM
2	Protocol activated on COM1	R	ROM
3	Protocol activated on EXP1	R	ROM
4	Protocol activated on COM2	R	ROM
5	Protocol address	R	TAMP
1000 ÷ 1129	Word area special marker SM	R/W	TAMP
2000 ÷ 2349	Word area variables V	R/W	TAMP
12000 ÷ 12047	Word area timer T	R/W	0
13000 ÷ 13047	Word area preset timer PT	R/W	0
14000 ÷ 14015	Word area counters C	R/W	0
15000 ÷ 15015	Word area preset counters PV	R/W	0
19000 ÷ 19065	Word area analogue inputs AI	R	0
19400 ÷ 19463	Word area analogue outputs AQ	R/W	0
20000 ÷ 20999	Word area EEPROM	R/W	EEP

WORD			
MODBUS ADDRESS	**DESCRIPTION**	**READ/ WRITE**	**RESET VALUE**
19800 ÷ 19815	Word % prop/integr/deriv/outputs PID		
	% proportional action PID1		
19800	% integral action PID1		0
19801	% derivative action PID1		TAMP
19802	% output PID1	R	TAMP
19803	% proportional action PID2		TAMP
19804	…		0
19805	% output PID4		…
19815			TAMP
30000 ÷ 42999	Word area MMC	R/W	EEP

WORD			
MODBUS ADDRESS	DESCRIPTION	READ/ WRITE	RESET VALUE
100	N.O. contacts digital inputs I1÷I16	R	?
101	N.O. contacts digital inputs I17÷I32	R	?
102	N.O. contacts digital inputs I33÷I48	R	?
103	N.O. contacts digital inputs I49÷I64	R	?
104	N.O. contacts digital inputs I65÷I80	R	?
105	N.O. contacts digital inputs I81÷I96	R	?
106	N.O. contacts digital inputs I97÷I112	R	?
107	N.O. contacts digital inputs I113÷I128	R	?
108	N.O. contacts digital inputs I129÷I144	R	?
109	N.O. contacts digital inputs I145÷I160	R	?
110	N.O. contacts digital inputs I161÷I176	R	?
111	N.O. contacts digital inputs I177÷I192	R	?
112	N.O. contacts digital inputs I193÷I208	R	?
113	N.O. contacts digital inputs I209÷I224	R	?
114	N.O. contacts digital inputs I225÷I240	R	?
115	N.O. contacts digital inputs I241÷I256	R	?
150	N.O. contacts digital outputs Q1÷Q16	R	0
151	N.O. contacts digital outputs Q17÷Q32	R	0
152	N.O. contacts digital outputs Q33÷Q48	R	0
153	N.O. contacts digital outputs Q49÷Q64	R	0
154	N.O. contacts digital outputs Q65÷Q80	R	0
155	N.O. contacts digital outputs Q81÷Q96	R	0
156	N.O. contacts digital outputs Q97÷Q112	R	0
157	N.O. contacts digital outputs Q113÷Q128	R	0
158	N.O. contacts digital outputs Q129÷Q144	R	0
159	N.O. contacts digital outputs Q145÷Q160	R	0
160	N.O. contacts digital outputs Q161÷Q176	R	0
161	N.O. contacts digital outputs Q177÷Q192	R	0
162	N.O. contacts digital outputs Q193÷Q208	R	0
163	N.O. contacts digital outputs Q209÷Q224	R	0
164	N.O. contacts digital outputs Q225÷Q240	R	0
165	N.O. contacts digital outputs Q241÷Q256	R	0
200	N.O. contacts bistable relays B1÷B16	R/W	0
201	N.O. contacts bistable relays B17÷B32	R/W	0
300	N.O. contacts timer T1÷T16	R	0
301	N.O. contacts timer T17÷T32	R	0
302	N.O. contacts timer T33÷T48	R	0
350	N.O. contacts counters C1÷C16	R	0

WORD			
MODBUS ADDRESS	**DESCRIPTION**	**READ/ WRITE**	**RESET VALUE**
90	N.O. contact positioning on/off POS1÷POS2	R	0
95	N.O. contact tuning Positioning on/off POS1÷POS2	R	0
250	N.O. contact support marker M1÷M16	R	0
251	N.O. contact support marker M17÷M32	R	0
252	N.O. contact support marker M33÷M48	R	0
253	N.O. contact support marker M49÷M64	R	0
254	N.O. contact support marker M65÷M80	R	0
255	N.O. contact support marker M81÷M96	R	0
256	N.O. contact support marker M97÷M112	R	0
257	N.O. contact support marker M113÷M128	R	0

BIT			
MODBUS ADDRESS	DESCRIPTION	READ/ WRITE	RESET VALUE
1600 ÷ 1855	N.O. contact digital input I1 ÷ N.O. contact digital input I256	R/W	?
2400 ÷ 2655	N.O. contact digital output Q1 ÷ N.O. contact digital output Q256	R/W	0
3200 ÷ 3231	N.O. contact bistable relay B1 ÷ N.O. contact bistable relay B32	R/W	0
4800 ÷ 4847	N.O. contact timer T1 ÷ N.O. contact timer T48	R	0
5600 ÷ 5615	N.O. contact counter C1 ÷ N.O. contact counter C16	R	0
1440 ÷ 1441	N.O. contact positioning on/off POS1 ÷ N.O. contact positioning on/off POS2	R	0
1520 ÷ 1521	N.O. contact tuning Positioning on/off POS1 ÷ N.O. contact tuning Positioning on/off POS2	R	0
4000 ÷ 4127	N.O. contact support marker M1 ÷ N.O. contact support marker M128	R/W	0
32000 ÷ 37599	Bit 0 area marker V0 ÷ Bit 15 area marker V249	R/W	TAMP
16000 ÷ 18079	Bit 0 area special marker SM0 ÷ Bit 15 area special marker SM129	R/W	TAMP

2 PL260 Ladder programming

2.1 Introduction

The software tool "PLProg" for Windows allows programming the module PL260. The ladder programming enables drawing the logic diagram of the application and uploading it to the PLC.

2.2 Elements of Ladder programming

Available elements with relevant features, to create the ladder diagram, are listed below.

2.2.1 Contacts digital inputs I

Contacts I contains the state of digital inputs of PL260 and of one more expansion module. The N.O. contact is closed (on) when bit value is 1 (active input). The N.C. contact is open (on) when bit value is 0 (input not active).

2.2.2 Digital outputs Q

PL260 is provided with 256 outputs type “Q”, each composed of one coil and the relevant logic contact N.O. and N.C. which may be used to draw the ladder diagram. On PL260 hardware only 16 static outputs Q are physically available, the other ones are available as auxiliary outputs or on expansion module (if present).
Energizing coil “Q” , the relevant logic contact will close (N.O.) or open (N.C.). The contacts of physical outputs are all N.O. and at starting all contacts N.O. are open.

2.2.3 Bistable relays B

64 bistable relays are available on PL260. Each consists of one coil and the relevant logic contact N.O. and N.C. .
Energizing coil “B”, the relevant logic contact will change its state (it opens if previously closed, it closes if previously open). The N.O. contact is closed (on) when bit value is 1. The N.C. contact is open (on) when bit value is 0. At starting of PLC the N.O. contact is open.

2.2.4 Timer T

Three different operating modes are available for Timers:

- **TON.** Mode **Start timing as delay at activation** counts time when coil is active (ON). Timing bit (contact T) is activated when actual value (T) is equal or higher than preset time (PT). When coil is deactivated (OFF), actual value of timer is reset. Timer keeps on counting after reaching preset value and it stops reaching the max. value 32767.
- **TOFF.** Mode **Start timing as delay at deactivation** allows to delay the deactivation of an output for a certain time after the input has been deactivated. When the coil is activated, the timing bit (contact T) is immediately activated and the actual value (T) is set to zero. At deactivation of coil, the timer counts until elapsed time is equals to preset timer (PT). After reaching the preset timer, timing bit is deactivated and actual value does not increase. If input is deactivated for a time which is lower than preset time, the timing bit is still active. To start counting, the function TOF must notice a transition from activated to deactivated (ON → OFF).
- **TONR.** Mode **Start timing as delay at activation with memory** counts time when coil is activated (ON). Timing bit (contact T) is activated when actual value (T) is bigger or equals to preset time (PT). When coil is deactivated (OFF), actual value of timer “delay at insertion with memory” is stored. This value allows to accumulate time for more activation peroids of the coil. Actual value of timer can be reset with operation MOV(Tx = #0). Timer keeps on counting after reaching preset value and it stops reaching the max. value 32767.

Timers with operating modes TON, TONR and TOF are available in three different resolutions, not depending from number of timer; they can be

activated with time basis 10 ms, 100ms and 1s. Each counting of actual value is multiple of time base. Example a counting of 50 in a timer with time base 10 ms is equals to 500 ms.
Preset time (PT) can be directly loaded with a value or by means of a variable in the area VW, SMW, AI , TR.

2.2.5 Counter C

Counters are available with two operating modes:

- **MUP.** In mode **Count Up** the counting bit (contact C) is activated when present value (C) is >= to preset value (PV). Counter counts up every time that the counting-up input Cx(UP) goes from Off to On and it counts down every time that the counting-down inputs Cx(DOWN) goes from Off to On.
  The counter is reset when the reset input Cx(RESET) is activated or when the operation MOV(Cx = #0) is executed. At reaching of max. value (32.767), the next edge-up of the counting-up input will keep unchanged the actual value. Similarly at reaching of minimum value (-32.768) the next edge-up of the counting-down input will keep unchanged the actual value.

  MDOWN. In mode **Count Down**, the counting bit (contact C) is activated when present value is equals to zero. The counter counts down starting from a preset value (PV) on the edge-up of the counting-down input Cx(DOWN) and it counts up on the edge-up of the counting-up input Cx(UP). At reaching of max. value (32.767), the next edge-up of the counting-up input will keep unchanged the present value. The counter resets the counting bit (contact C) and load present value with preset value (PV) when loading input Cx(RESET) is activated. The counter in mode count-down stops counting when it reaches zero. Please use number of counter to refer both to actual value and to Contact C of the counter itself

Preset value (PV) may be directly loaded with a value or it may be loaded by one the variables in the area VW, SMW, AI, TR.

2.2.6 Mathematical formule FM function

The function FM allows to perform math operations (+, -, *, /, |, &, ^, <<, >>) between two operators and to save the result in another memory location.

The operators can be numeric or they may also refers to available memory areas.

2.2.7 Assignement function MOV

The function MOV allows to assign to the specified memory location a numeric value or a value assumed by another memory location.

2.2.8 Assignement function BLKMOV

The function BLKMOV allows to assign to the memory block a numeric value or the value assumed by another block of memory locations.

2.2.9 Indexed Assignement Function MOVIND

The indexed assignment function MOVIND allows to assign to a certain memory location specified by another memory location a numeric value or the value assumed by another memory location selected in the area specified by a memory location which is the index. This type of assignment allows to consider the memory areas as vectors of a certain number of locations: by means of the value assumed by another location called “index” it is possible to enter the value of the area n=0, n=1, …, n=N-1.

2.2.10 Assignement function MOVTXT

Starting with the specified memory location, the assignment function MOVTXT allows to save the characters of a string sent as parameter to the function. Following types of format are available for characters of string in the memory area:

- **ONE_CHARACTER_PER_WORD**: in this format each word of destination area will contain **only one character of string**
- **TWO_CHARACTERS_PER_WORD**: in this format each word of destination area will contain two characters of string, starting with high area of the word.

2.2.11 Contacts II immediate digital inputs

Contacts II allow to read immediately the state of digital input. The N.O. contact is closed (On) when bit value is 1 (active input). The N.C. contact is open (On) when bit value is 0 (deactivated input).

2.2.12 Immediate outputs QI

By means of direct access to outputs Q, PL260 allows to directly work on outputs Q during the ladder program execution, even without waiting the end of program. The command is allowed only on hardware outputs of PL260 (QI1..QI16).

2.2.13 IF contact

The operation “conditional comparison IF” allows to compare the values of 2 variables in any memory area. Following comparisons are allowed:
=, >=, <=, >, <, <>. Contact is active when comparison is true.

2.2.14 SBIT and RBIT functions

SBIT function, bring to "1" a bit of a memory area, while the coil of the function is active.
RBIT function, bring to "0" a bit of a memory area, while the coil of the function is active.
Number of bit changes from 0 to 15, where bit 0 is the less significant bit (LSB).

2.2.15 BIT contact

This operation brings the value of a memory area bit. Contact normally open is closed (off) when the bit is 1. The contact normally closed is opern (on) when the bit is 0. Number of bit changes from 0 to 15, where bit 0 is the less significant bit (LSB).

2.2.16 RANGE function

The RANGE function defines minimum and maximum limits for analogue inputs AI, for trimmer TR, for analogue outputs AQ and for PID outputs.

Concerning analogue inputs AI and trimmer TR, the minimum and maximum values allow to translate the counts value of the analogue-digital conversion into a value which can be used inside the program. Below an example:

RANGE(AI1, Min 10, Max 200)

For analogue input AI1 the function defines the minimum limit as 10 and the maximum limit as 200. In case that analogue input AI1 would be connected to a potentiometer to fix a preset time (PT) of a timer with time-base 100ms, the result would be a variable time between 1.0 and 20.0 seconds, according to the position of potentiometer.

Concerning analogue outputs AQ, minimum and maximum value allow to rate the effective tension value of output 0÷10V. Below an example:

RANGE(AQ1, Min -200, Max 500)

For analogue output AQ1 the minimum limit is fixed as –200 and the maximum limit is fixed as 500. This means that setting numeric value of output as –200, the output AQ1 will be 0 Volt while setting the numeric value as 500 the output AQ1 will be 10Volt. In case that entered value are not included in the interval specified by function RANGE, the output is kept within minimum and maximum values. For intermediate values, output tension is rated according to following formula:

Output(volt) = ((Value – Min) * 10) / (Max – Min)

Maximum resolution for output AQ1 and AQ2 is 8 bit.

Concerning PID outputs, minimum and maximum values allow to rate the value for the output of PID control algorithm. Below an example:

RANGE(PID1, Min 100, Max 500)

For PID1 output , minimum limit is fixed as 0 and maximum limit is 500. This means that for output 0% the PID output will be equals to minimum fixed value and for output 100% the PID output will be equals to maximum fixed value. For each PID [1..8], minimum and maximum values of output are initialized at starting as 0 and 10000.

2.2.17 Contact NOT

The operation NOT modifies logic value from 0 to 1 or from 1 to 0.

2.2.18 Contact P and N

The contact “positive transition P” activates the current flow for a single scanning cycle at each transition Off / On. The contact “negative transition N” activates the current flow for a single scanning cycle at each transition On / Off. When the operation “positive transition P” detects a transition of logic value from 0 to 1, it sets this value to 1, otherwise to 0. When the operation “negative transition N” detects a transition of logic value from 1 to 0, it sets this value to 1, otherwise to 0.

2.2.19 Function SEND and mode Free-port

Function SEND allows to activate data transmission by means of serial ports in mode free-port. In this mode, which can be activated by special marker SM32, SM33 and SM34, the protocol which usually handles the serial ports is disabled and the ports, as well as the relevant TX and RX buffers, are controlled by the ladder program. After loading on buffer the data to send and activating function SEND (which uses serial port and no. of characters to send as parameters) these data will be sent on serial line. During the transmission of data, bit SM0.7, SM0.7 or SM0.8 (according to transmission port) will be set to “1”, while it will be set to “0” at the end of transmission. It is possible to check the answer of a connected device by means of SM35, SM36 and SM37, which contain the number of characters received and saved on RX buffer of each serial port. Any writing on each of these special marker will empty the RX buffer. Calls to function SEND before the end of previous transmission or with mode free-port disabled will be ignored by the program.

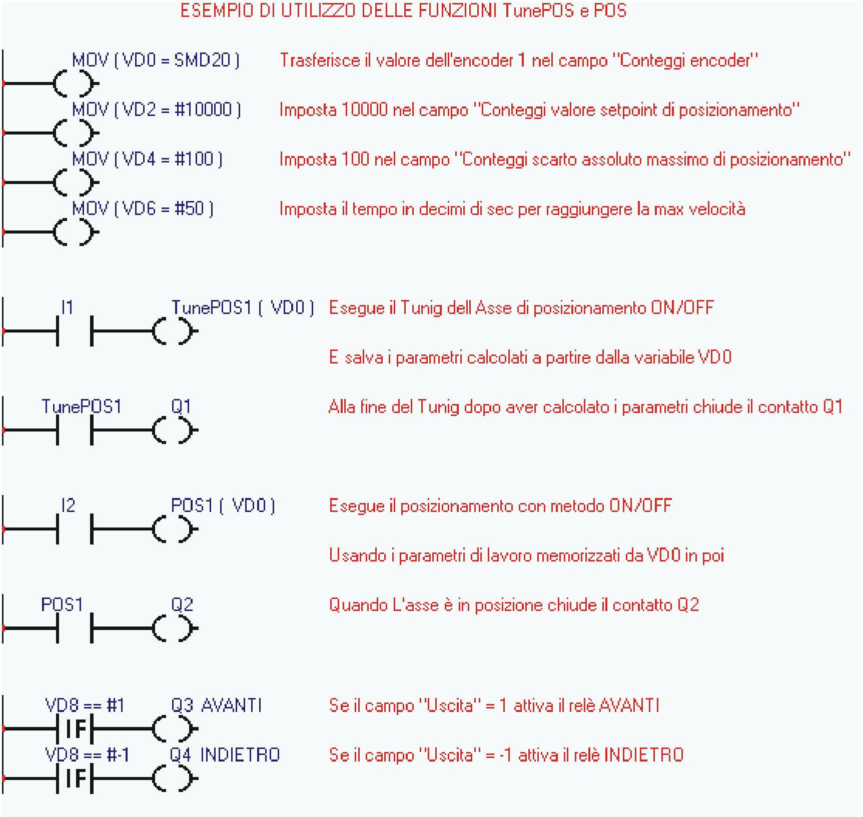
2.2.20 Function TunePOS and POS (positioning axis ON/OFF)

Function “TunePOS” completes the autotuning which is necessary to rate reaction time and inactivity time of the axis on which a positioning procedure is required. The function “POS” proceeds to the ON/OFF positioning of an axis. Both functions operate on the same memory area with double word access (area marker VD); the start address of the used memory area is required as parameter by functions “TunePOS” and “POS”. The following table shows how data is organized in the memory area used by the two functions, starting from the address of specified location.

Address area VD	Contents
+0	Encoder counts
+2	Counts setpoint value of positioning
+4	Counts maximum positioning error
+6	Time required to reach max. speed (tenth of seconds)
+8	Status of positioning output (0=stop, 1=onwards, -1=backwards)
+10	Counts of inertia onwards
+12	Counts of inertia backwards
+14	Duration minimum impulse (resolution 0.2 mS)
+16	Counts of displacement after impulse of 100 mS
+18	Counts of displacement after impulse of 500 mS
+20	Counts of displacement after impulse of 1000 mS

To use these functions, proceed as follows:

- Use ladder instruction “MOV” to transfer the counting of used encoder (SMD20 = Encoder 1, SMD22 = Encoder 2) in the field “Encoder counts”.
- Enter the counts value for axis positioning in the field “ Counts setpoint value of positioning ”
- Enter the counts value of max. error allowed to positioning in the field “Counts maximum positioning error”
- Enter time value (as tenths of second) required for the axis to reach max. speed.
- Start function “TunePOS” and wait until contact “TunePOS no” closes to notify end of Autotuning procedure for axis. Data concerning inertia and reaction time are now automatically stored on the indicated memory area where they remain at disposal for function “POS”.
- Disable function “TunePOS”.
- Start function “POS”. When the axis reaches the setpoint (except for preset error), contact “POS no” will close to notify end of positioning
- Activate the outputs ONWARDS and BACKWARDS reading value in the field “Output”. If value of “Output” is given by functions “TunePOS” and “POS” as “1”, the output ONWARDS must be activated; if it is “-1” the output BACKWARDS must be activated; if it is “0” no output must be activated.
- Set to zero the value of field “Output” when the functions “TunePOS” or “POS” are disabled, to avoid that output is still set as Onwards or Backwards.



ESEMPIO DI UTILIZZO DELLE FUNZIONI TunePOS e POS

Trasferisce il valore dell'encoder 1 nel campo "Conteggi encoder"

Imposta 10000 nel campo "Conteggi valore setpoint di posizionamento"

Imposta 100 nel campo "Conteggi scarto assoluto massimo di posizionamento"

Imposta il tempo in decimi di sec per raggiungere la max velocità

Esegue il Tunig dell Asse di posizionamento ON/OFF

E salva i parametri calcolati a partire dalla variabile VD0

Alla fine del Tunig dopo aver calcolato i parametri chiude il contatto Q1

Esegue il posizionamento con metodo ON/OFF

Usando i parametri di lavoro memorizzati da VD0 in poi

Quando L'asse è in posizione chiude il contatto Q2

Se il campo "Uscita" = 1 attiva il relè AVANTI

Se il campo "Uscita" = -1 attiva il relè INDIETRO

2.2.21 Function serial communication COM and EXP

Communication functions COM and EXP enable the programming of the serial ports (COM1-RS485 and EXP1-RS232) for reading/writing of data from connected slave devices using the master protocol selected in the project. These functions are active only when in the project a master communication protocol has been selected for the relevant serial port. A Master protocol means a protocol which enables the PL260 to control the serial line communication, controlling the data flow towards slave devices. The two functions are similar, they only refer to a different serial port. Instruction COM operates with interface RS485, allowing to connect more devices on the same line, while instruction EXP operates with interface RS232 allowing to connect one single device to PL260. Instructions are active while the relevant coil is active. Consider also that, according to communication protocol, the time required for data update can be quite different and read data is not immediately available at activation of coil, but only after a certain time depending from communication delays.

Instructions COM and EXP require the configuration of following parameters:

- Index (max. 16 different serial pollings)
- Type of operation:
- Reading: PL260 will read continuously data from slave device and will store them in an internal memory area
- Writing: PL260 will write continuously data on an internal memory area of the slave device
- Reading/Writing: PL260 will read data on slave device and will store them in an internal memory area; when these internal data on PL260 will be modified by the program, any change will be automatically sent also to slave device by means of a writing instruction (this instruction can work only on a single data each time).
- Slave number (communication address of slave device)
- Data type (word or bit)
- Number of data (or starting number in case of more data)
- Internal memory area of PL260 where data must be read/written
- Word number (the same reading / writing instruction can work simultaneously on more consecutive data

“NAIS MATSUSHITA-MASTER” PROTOCOL

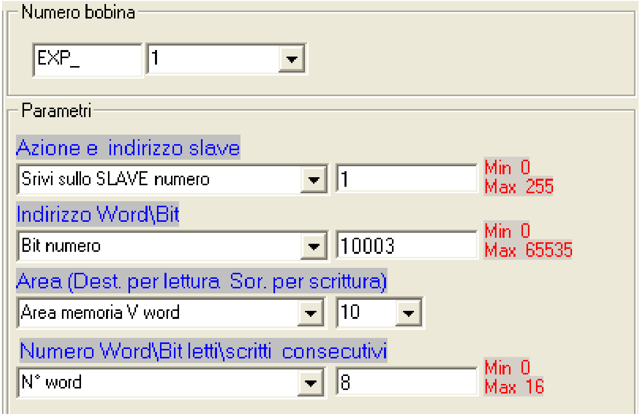
This communication protocol allows to read/write data (bit or word) on a Nais - Matsushita plc. Generally, communication interface is a RS232 and communication format is 9600,8,O,1.

The following tables show all elements which can be read/written by the plc. The address bit or word to be read/write is obtained adding the real bit/word address (between Min and Max) to the value showed in the Offset column. Each instruction "COM" or "EXP" can execute reading/writing for each type of data which is indicated in the column "Max number of consecutive bid/word read/wrote".

ACCESS TO BIT						
Contact	Notation	Min	Max	Offset	R/W	Max number of consecutive bit read/wrote
External input	“X”	0	9999	0	R	8
External output	“Y”	0	9999	10000	R/W	8
Internal relay	“R”	0	9999	20000	R/W	8
Link relay	“L”	0	9999	30000	R/W	8
Timer	“T”	0	9999	40000	R	8
Counter	“C”	0	9999	50000	R	8

ACCESS TO WORD						
Data Code	Notation	Min	Max	Offset	R/W	Max number of consecutive word read/wrote
External input	“X”	0	999	0	R	10
External output	“Y”	0	999	1000	R/W	10(R) / 7(W)
Internal relay	“R”	0	999	2000	R/W	10(R) / 7(W)
Link relay	“L”	0	999	3000	R/W	10(R) / 7(W)
Timer	“T”	0	999	4000	R	10
Counter	“C”	0	999	5000	R	10
Index register X		0	0	6000	R/W	1
Index register Y		0	0	6001	R/W	1
Index register D		0	0	6002	R/W	1
Data register	“DT”	0	9999	10000	R/W	10(R) / 7(W)
Link data register	“LD”	0	9999	20000	R/W	10(R) / 7(W)
File register	“FL”	0	9999	30000	R/W	10(R) / 7(W)
Set value area		0	9999	40000	R/W	10(R) / 7(W)
Elapsed value area		0	9999	50000	R/W	10(R) / 7(W)

N.B.: On PL260-XX protocol, only elements underlined in grey are enabled (the other elements have not to be used!). The example below describes setting for an "EXP" instruction to write on the plc with "1" of 8 consecutive bit on "external output" Y3 and YA, taking value from VW10.



Numero bobina

EXP_ 1

Parametri

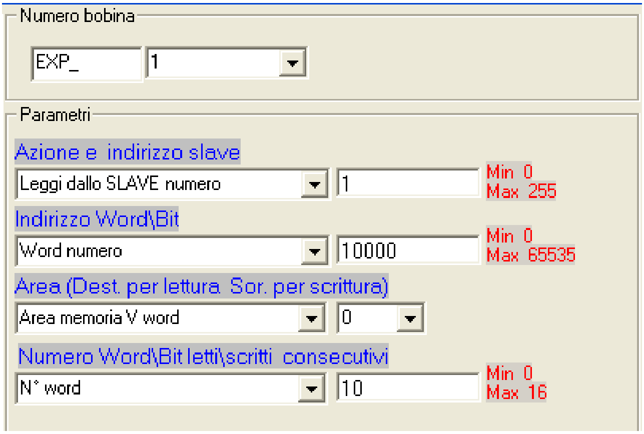
Azione e indirizzo slave: Srivi sullo SLAVE numero 1 (Min 0 Max 255)

Indirizzo Word\Bit: Bit numero 10003 (Min 0 Max 65535)

Area (Dest. per lettura Sor. per scrittura): Area memoria V word 10

Numero Word\Bit letti\scritti consecutivi: N° word 8 (Min 0 Max 16)

Following example describes the setting for an "EXP" instruction to read from the plc with address "1" of 10 consecutive bit from "data register" DT0 to DT9, keeping read value on area VW0..9.



Numero bobina

EXP_ 1

Parametri

Azione e indirizzo slave: Leggi dallo SLAVE numero 1 (Min 0 Max 255)

Indirizzo Word\Bit: Word numero 10000 (Min 0 Max 65535)

Area (Dest. per lettura Sor. per scrittura): Area memoria V word 0

Numero Word\Bit letti\scritti consecutivi: N° word 10 (Min 0 Max 16)

2.2.22 MapEXP mapping function for external I/O

MapEXP communication function allows to declare expansion devices of I/O expansion connected to the port EXP1 for the automatic reading/writing of input/outputs and data. This function is activated only when for the serial port EXP1 on the project the communication protocol EXP-I/O-CANBUS is selected. This protocol allows PL260 to take the control of the CANbus communication line, controlling data flow towards slave devices.

This instruction will be active until the corresponding coil results active.
It is necessary to know that required time for data updating can change sensibly and that at coil start, read data is not available instantly but only after a certain time (due to communication delays).

MapEXP instruction needs this setting parameters:

- I/O device address (it is possible to select at max. 15 I/O devices), connected to the CAN bus; this number will correspond to that of the communication address selected on the I/O module.

- Type of connected[8] I/O device:
  - **MCM260-1AD** (16 digital outputs)
  - **MCM260-2AD** (16 digital inputs)
  - **MCM260-3AD** (8 digital inputs + 8 digital outputs)

At each I/O device, some resources (on the PL260 memory areas) are reserved to manage clearly the data exchange between plc and expansion modules, as if the inputs/outputs were internal to the plc:

- 16 digital inputs
- 16 digital outputs
- 4 analogue inputs / outputs
- 10 word on V area

Not all expansion modules utilize all available resources; unutilized areas are used by the ladder program for other uses.

The table below summarizes, for each type of device which can be connected to the PL260 expansion bus, how many I/O or variables V it takes into the plc internal memory.

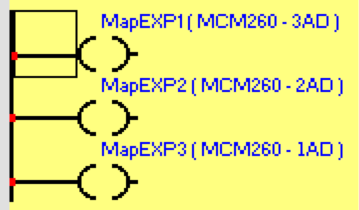
Device	**I**	**Q**	**AI**	**AQ**	**VW**
MCM260-1AD	-	16	-	-	-
MCM260-2AD	16	-	-	-	-
MCM260-3AD	8	8	-	-	-

[8] actually only 3 I/O modules are available and can be connected to the plc. Shortly other modules will be provided to manage analogue inputs/outputs and other functions.

The table below summarizes the addresses of the areas reserved to I/O devices, according to their communication address:

Addr.	I	Q	AI	AQ	VW
1	17-32	17-32	7-10	5-8	200-209
2	33-48	33-48	11-14	9-12	210-219
3	49-64	49-64	15-18	13-16	220-229
4	65-80	65-80	19-22	17-20	230-239
5	81-96	81-96	23-26	21-24	240-249
6	97-112	97-112	27-30	25-28	250-259
7	113-128	113-128	31-34	29-32	260-269
8	129-144	129-144	35-38	33-36	270-279
9	145-160	145-160	39-42	37-40	280-289
10	161-176	161-176	43-46	41-44	290-299
11	177-192	177-192	47-50	45-48	300-309
12	193-208	193-208	51-54	49-52	310-319
13	209-224	209-224	55-58	53-56	320-329
14	225-240	225-240	59-62	57-60	330-339
15	241-256	241-256	63-66	61-64	340-349

The example below shows how to activate the management of three devices, it is possible to see that: the module with address 1 is a MCM260-3AD, those with address 2 is a MCM260-2AD and those with address 3 is a MCM260-1AD. Digital inputs/outputs will be available for the address indicated near the figure.



→ I17..I24 e Q17..Q24

→ I33..I48→ Q49..Q64

2.2.23 Functions StartPID , PID , SetOutPID

Functions StartPID, PID and SetOutPID enables control of a process by means of PID algorithm (proportional, integral, derivative).

Function StartPID starts the relevant control block and sets parameters as required. Function can be activated once at the starting or it may be recalled later to modify quickly control parameters. PID integral action is initialized only calling this function and setting integral time to 0, otherwise even in case of switch-off the system will start control action keeping the same percentage of integral action and consequently limiting the transient times. Parameters required by function StartPID are the following:

- Proportional band
- Integral time
- Derivative time
- Dead band

Parameters can be entered with numeric format or referring to internal variables. Integral time is expressed in time unit used for PID function (ex. PID function recalled every 1 sec., integral time expressed in seconds). Derivative time is expressed with one decimal digit more than integral time. Proportional band and dead band are expressed with a numeric value as setpoint and process.

PID function requires following parameters:

- Setpoint
- Process
- Output value
- Type of control action
- Type of output

After acquisition of necessary parameters values, PID function will enter the value obtained by control algorithm in the variable “Output value”. This value will have been obtained rescheduling the percentage value 0 – 10000 (0.00% ÷100.00%) between minimum and maximum value of PID output as entered using the function RANGE.

For optimal results, PID function should be recalled at regular intervals. A timer can be used or even an internal Interrupt, to get shorter intervals.

Function SetOutPID is used for control actions which foresee both automatical and manual functions. The function allows to avoid process oscillations when changing from manual to automatical PID control. Following parameters are required:

- Output value

It allows to set the value of PID output, automatically rating the single percentages of proportional and integral action. Changing from manual to automatical operation, PID output will assume the value entered in manual function and it will start control action.
Consequently the function must be used only in manual control, to keep PID output in line with value of manual control.
This function automatically cancels derivative action.
If the function is used with process value outside proportional band, integral action will be set to 0.

2.2.24 Functions StartPOSPID and POSPID

Functions StartPOSPID and POSPID are conceived to assure a simple and quick positioning by reading encoder 1 and by motor control with a tension +/- 10V generated as differential by outputs AQ1and AQ2. Positioning is achieved with PID algorithm, adding also action "F" , which is due to theoric speed of axis motion.
Function StartPOSPID activates control action, setting the parameters as required. The function can be activated once at starting but it may also be recalled later for a quick change to control parameters. Integral action of PID is initialized only starting this function and setting integral time to 0. Otherwise , even in case of switch-off, the system will start regulation keeping as reference the same percentage of integral action, therefore limiting the time of transient.
Parameters required for function StartPOSPID are the following:

- Proportional band
- Integral time
- Derivative time
- Dead band

Parameters can be entered with numeric format or even referring to internal variables. Integral time is expressed with time unit used to recall function POSPID (ex. function POSPID recalled every 1 ms >> Integral time expressed as milliseconds). Derivative time is expressed with one decimal point more than integral time. Proportional band and dead band are expressed as counts, since they refer to encoder 1.

Parameters required for function POSPID are the following

- Setpoint (counts)
- Value of action F (+/- 10000)
- Output limits (0…10000)

Function POSPID, after getting setpoint value expressed as counts, value of action "F" and limit of output, will rate value of analogic outputs AQ1 and

AQ2, so that value of counts for encoder 1 will be equal to selected setpoint. Value of action “F” will be added to the output value rated by PID (max +/-10000). Keeping value of action “F” to 0 a zero, this action will not affect regulation. The limit of output is conceived to limit the motion speed of axis, particularly setting the limit to 5000 the combined output AQ1 and AQ2 will assume max values +/-5.0V.
To assure optimal operation, the function POSPID must be recalled at regular intervals, therefore it is possible to use an internal interrupt. All data used by these functions are “double word” type(32 bit).

2.2.25 Function GENSET

Function GENSET allows to generate automatically a variable setpoint, with option to enter an acceleration and deceleration ramp. Function GENSET operates on a series of adjoining variables in double word, starting with the location which is given as parameter of the function.

Addres s area VD	Contents
+0	State of function GENSET 0 → Stop or end motion 1 → Function initialization 2 → Acceleration ramp 3 → Motion at constant speed 4 → Deceleration ramp
+2	Starting Setpoint / Setpoint rated at end of GENSET function (counts)
+4	Final setpoint (counts)
+6	Motion speed (counts * 1000 / time units)
+8	Duration of acceleration ramp (time units)
+10	Duration of deceleration ramp (time units)
+12	Instant speed of setpoint (counts * 1000 / time units)

To use this function, proceed as follows:

- Enter on location VD+2 the starting setpoint
- Enter on location VD+4 the final setpoint
- Enter on location VD+6 max. motion speed as counts*1000/time units (to have 3 decimals. Example: setting 12345 will give a speed of 12.345 counts/time units).

- Enter on location VD+8 the duration of accelaration ramp (expressed as time units; if duration of acceleration ramp must be 1 second and function GENSET is recalled by an interrupt of 1 ms, enter 1000)
- Enter on location VD+10 the duration of deceleration ramp.
- Write “1” on location VD to start the function which will automatically start to write on location VD+2 the generated setpoint. Location VD will also be updated with current state of function, while location VD+12will be updated with instant speed of setpoint, expressed with 3 decimals. This value may be used to generate action “F” for function POSPID.

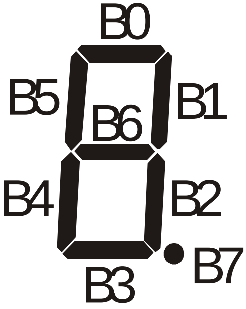
At end of motion, when location VD+2 will reach value of final setpoint, the function will automatically enter standby mode, indicated by value “0” on location VD. This means that function GENSET can be always active, even when motion is not required.

2.2.26 Function CONV

The function CONV provides the conversion of source data in one of the available formats. Conversion type “TO_7SEG_SIGNED” converts input data (one word with sign -32768..32767) in a specified number of digits alredy suitable for a display with 7 segments. The number of digits to convert, starting from less significant digit, will be sent to the function as parameter.

The codes will be saved (one digit for each word) starting from destination word and then in the following words accordino to the required number of digits.

Coversion type “TO_7SEG_UNSIGNED” is similar to the above described conversion. The difference is that the source data is considered as unsigned word (0..65535). the code is composed by one bit set to 1 if the segment must be ON and by one bit set to if the segment must be Off. The correspondance between bit and segment is the following:



Conversion type “TO_ASCII_SIGNED” converts the entering data (one word with sign -32768..32767) in a specified number of ascii characters. The number of characters to save will be assigned to this function as parameter. Codes of these characters will be saved (one character per word) starting with the destination word and then in the following ones, according to the no. of required characters.

Conversion type “TO_ASCII_UNSIGNED” is similar to the one described above, but the source data is meant as unsigned word (0..65535).

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Software Rev. 1.22 (firmware)

2300.10.077-RevJ 311012