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1.1 General

This manual describes the use (setup and operation) of the MOMENTUM line of discrete and analog I/O interfaces on PLCs via the FIPIO bus.
The FIPIO 170 FNT 110 01 communicator is used to connect sub-bases from the MOMENTUM product line to the FIPIO bus controlled by a TSX Premium PLC.

Setup of MOMENTUM products using PL7 is described in the TSX Micro / TSX Premium communication manual.
The following functions are provided :

- Writing of parameters to the sub-bases (on start-up and during operation)
- Management of cyclical exchanges of I/O data
- Management of diagnostic data

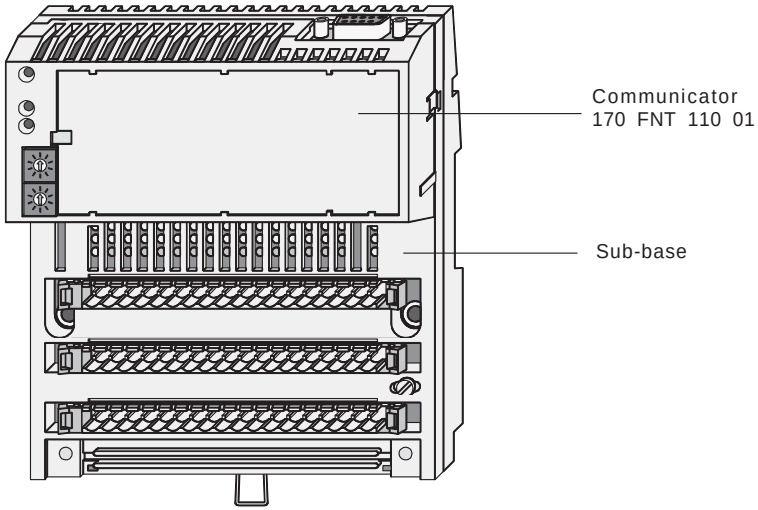
Message handling functions are not provided.

The hardware installation of Momentum sub-bases is described in the user manual : Modicon TSX Momentum I/O base.

The following terms will be used in this document :
Communicator refers to the communication module used for connection to the FIPIO bus. This is the 170FNT 110 01 product.
Sub-base refers to the I/O module from the MOMENTUM family which is used with the communicator.
Module refers to either the communicator or the sub-base.
Device refers to the functional assembly formed by a communicator connected to a sub-base.
Connection point refers to the address of the device connected to the FIPIO bus.

1.2 Physical Presentation

The FIPIO communicator is designed to be connected to a sub-base from the MOMENTUM family.
The communicator and the sub-base should be assembled before use, in accordance with the following diagram :
TSX Momentum sub-base and FIPIO communicator assembly.



For assembly, please refer to manual : 870 USE 002 01

1.2-1 Power Supply

The power supply for the FIPIO communicator is automatically provided by the sub-base to which it is connected. For the characteristics of the power supply and instructions for wiring it, please refer to the setup manual for the sub-base used. See manual : (870 USE 002 01).
The 170 FNT 110 01 communicator is compatible with all sub-bases in the MOMENTUM catalogue. It can only be used connected to a sub-base.

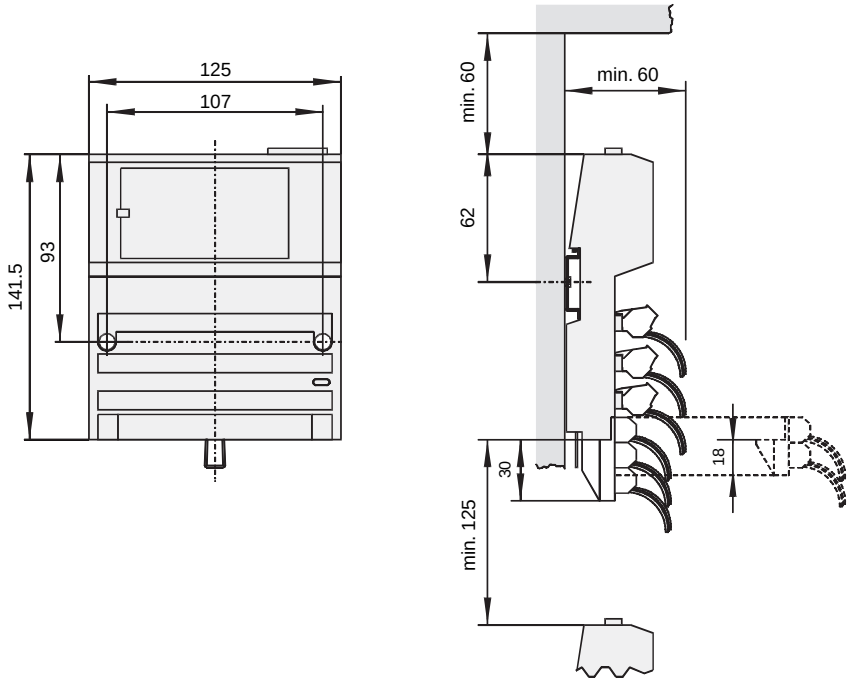
1.2-2 Connection to the FIPIO Bus

Various accessories are available to assist with wiring the FIPIO bus :

- TSX FP ACC12 and TSX FP ACC2 connectors for connecting the device to the FIPIO bus,
- TSX FP CA/CRxxx trunk cable sold in 100, 200 or 500 m lengths,
- TSX FP CCxxx drop cable sold in 100, 200 or 500 m lengths,
- TSX FP ACC14 and TSX FP ACC4 taps,
- TSX FP ACC7 line terminator,
- TSX FP ACC12 connector for connecting TSX Premium PLCs.

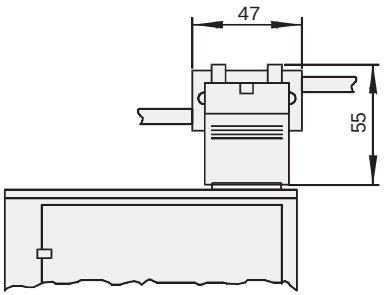
When MOMENTUM modules are installed in an enclosure, the use of the TSX FP ACC2 connector for connection to the FIPIO bus optimizes the size.

The following diagram shows the dimensions of a standard sub-base when it is connected to the FIPIO bus. The free spaces show the minimum clearances which must be observed for correct air circulation, whatever type of network connector is used.

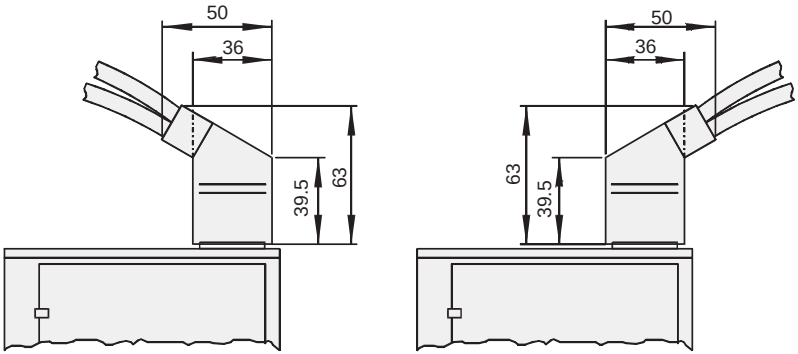


The following diagrams show the dimensions of the recommended connectors. If the ACC 12 connector is used, the free space above the MOMENTUM should be 150 mm and not 60 mm, because of the size of the FIP cables.

Connection using a TSX FP ACC2 connector :



Connection using a TSX FP ACC12 connector :



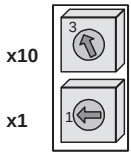
For further information on connection, please consult the FIPIO bus reference manual. This manual also provides detailed information on the operating characteristics and setup of a FIPIO fieldbus.

The manual "Electromagnetic compatibility of industrial networks and fieldbuses" contains important rules and installation recommendations for wiring a FIPIO fieldbus.

⚠ It is important to check that for each hardware cell, the garland of connectors is connected at one point at least to the protective earth ground.

2.1-1 Device FIPIO Addressing

A device on the FIPIO bus is identified by its connection point. The connection point number represents its physical address on the FIPIO bus and can take a value between 1 and 99.
On FIPIO, address 0 is reserved for the bus manager PLC. Address 63 is reserved for the programming terminal.
The FIPIO address of the device is configured using the two thumbwheels on the communicator.
The FIPIO address is coded in decimal format.
Example : coding of address 31



Modification of the address is only taken into account after the device has been powered down then powered up again.

Caution :
Modifying the address while the device is powered up will cause an internal fault and the disconnection of the device from the FIPIO bus.

Two devices on the FIPIO bus should never have the same address. Simultaneous flashing of the 3 indicator lamps (RUN, ERR, COM) for any length of time indicates that the device cannot be connected to the FIPIO bus as its address is already occupied by another device.

2.1-2 Procedure for Starting up the FIPIO Bus

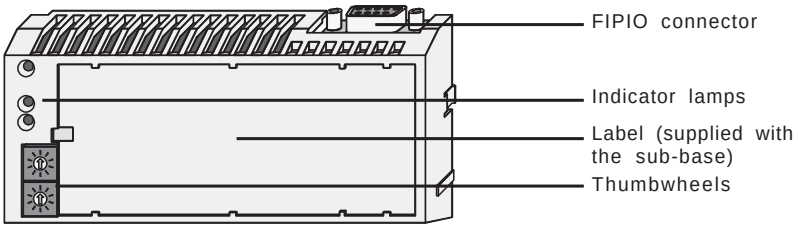
It is recommended that the devices are started up one at a time.
For a detailed description of starting up an application for the first time on FIPIO, please refer to the FIPIO bus reference manual TSX DR FIP.

2.1-3 Description of the Indicator Lamps on the Device

Communication module display block

The MOMENTUM family FIPIO communicator has a display block consisting of three indicator lamps (RUN, ERR, COM), which provide information on its status.

170 FNT 110 01 communicator

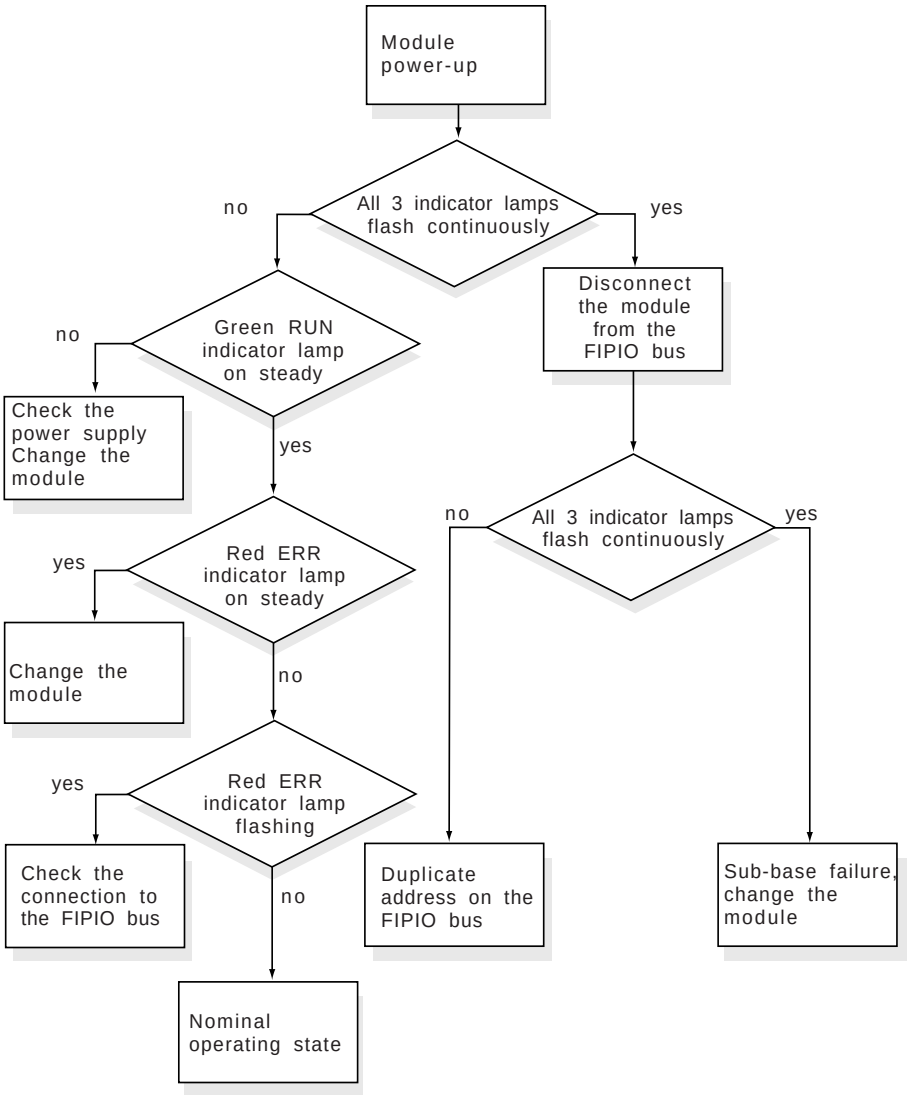


LED	Color	Description
RUN	**Green**	Device powered up **Off** if the device is powered down or totally off. **Flashing** if connection of the device to the bus has failed due to the presence of another device at the same address.
COM	**Yellow**	Communication function activity **Off** if there is no activity on the FIPIO bus or the communication function has stopped. **Flashing** during the self-test, initialization and connection phases of the device. **Flashing** when the device is taking part in exchanges on the FIPIO bus.
ERR	**Red**	Serious fault **Off** during normal operation of the device. **Flashing** during the self-test, initialization and connection phases of the device, and if the device is not logically connected to the FIPIO network. **On** if there is a fault requiring replacement of the device or one of its constituent modules : failure of a subassembly, or assembly of incompatible modules, etc.

Depending on the type of sub-base used, minor faults on the sub-base may be signaled by the indicator lamps on the sub-base itself. Please consult the manual for each sub-base to ascertain the meaning of the indicator lamps for that particular sub-base.

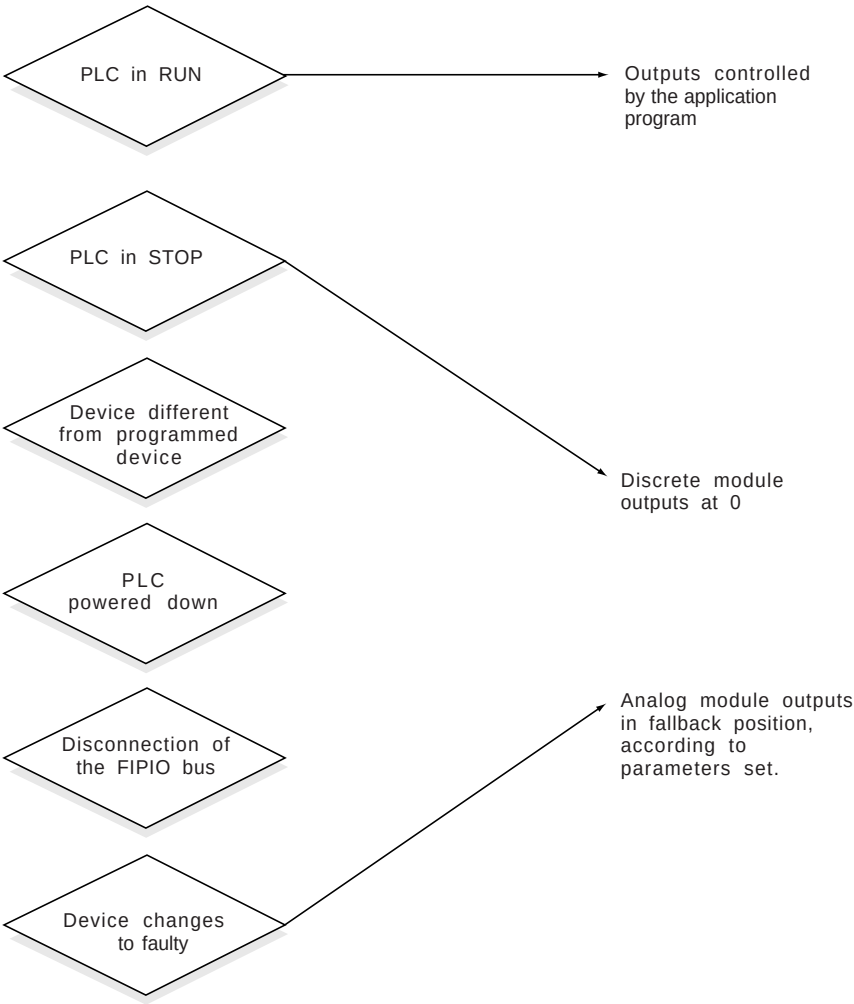
Fault information on the sub-base (for example, sensor supply fault) is given by the indicator lamps on the sub-base. For the layout and meaning of these indicator lamps, please consult the setup manual for the sub-base used (870 USE 002 01).

2.1-4 Visual Diagnostics Algorithm



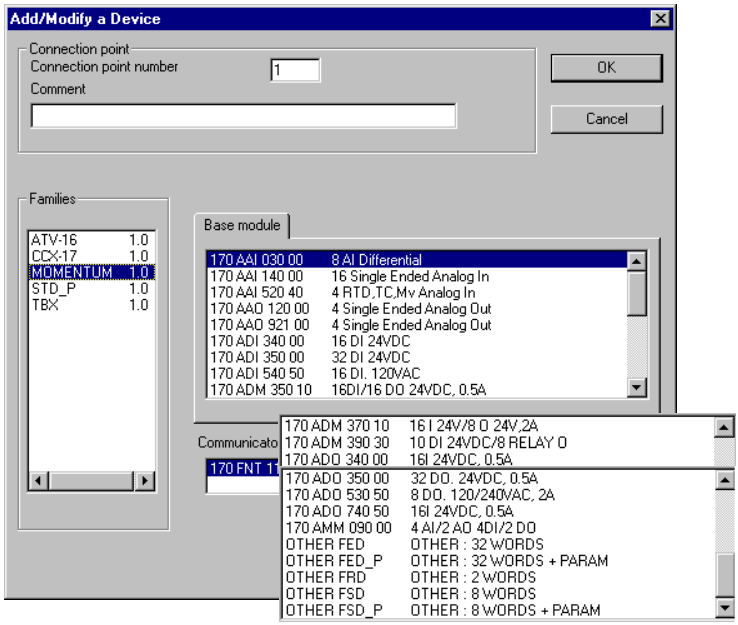
2.1-5 Output Operating Modes

The outputs of MOMENTUM modules follow the operating modes of the PLC and are controlled according to the values sent by the PLC at the end of each execution scan of the application program.
The outputs change to fallback position if there is an error on the PLC or device bus.



3.1 Programming Momentum Sub-bases Using PL7

The general principles, entering the configuration, and the syntax for accessing I/O objects are described in parts A and B of the Modicon TSX Micro / Premium / Pro PL7 setup manual. The syntax for accessing I/O objects or adjustment parameters is identical for all the modules available in the catalog and offered by PL7, and for the whole FIPIO bus.
For the use of modules not covered in the PL7 catalog, please refer to parts A and B for the use of standard profiles, Other xxx.
List of modules available in the catalog :

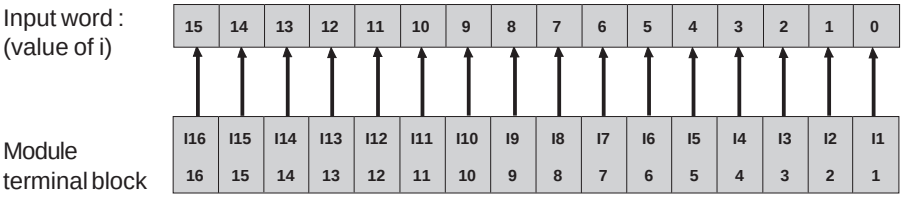


3.2 Addressing Momentum I/O Modules on FIPIO

3.2-1 16-channel Input Modules

- **170 ADI 340 00**
- **170 ADI 540 50**

The image of the input channels can be accessed using: %I\p.2.c\0.i,
i varies according to the following rule :



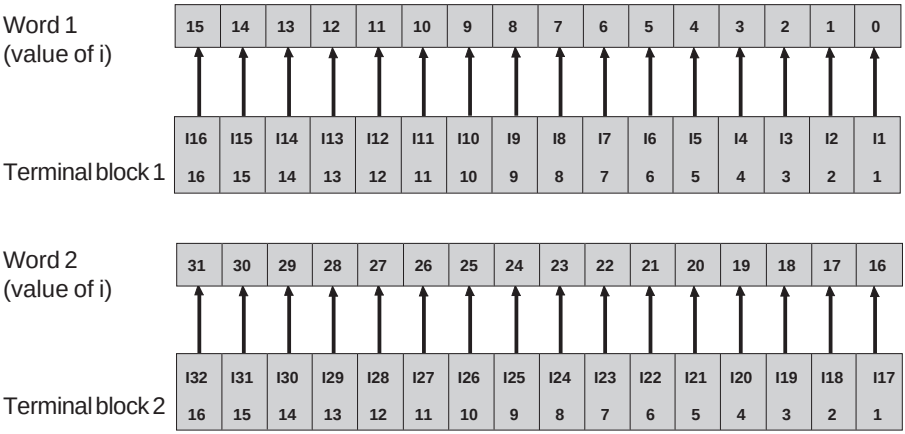
Bits : $16 \leq i \leq 31$ can be accessed by the program but are not significant.

p = location of the processor in the rack
c = connection point number

3.2-2 32-channel Input Module

- **170 ADI 350 00**

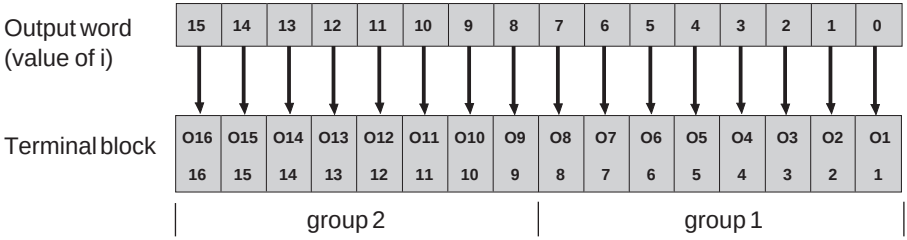
The image of the input channels can be accessed using : %I\p.2.c\0.i,
i varies according to the following rule :



3.2-3 2 x 8-channel Output Module

- **170 ADO 740 50**

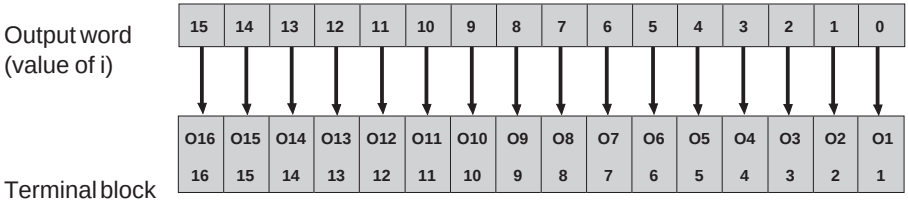
The image of the output channels is sent to the communicator using: %Q\p.2.c\0.i, i varies according to the following rule :



3.2-4 16 or 8-channel Output Modules

- **170 ADO 340 00** (16 channels)
- **170 ADO 530 50** (8 channels)

The image of the output channels is sent to the communicator using : %Q\p.2.c\0.i, i varies according to the following rule :

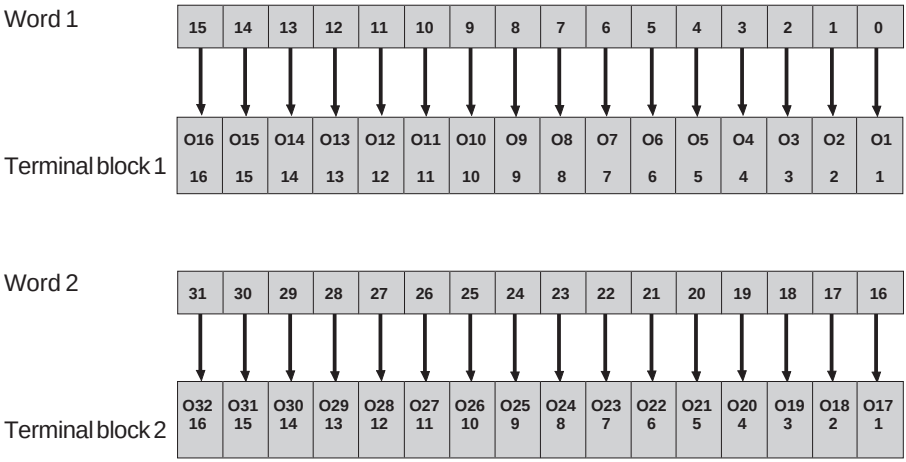


The bits of word %Q\p.2.c\0.i, $16 \leq i \leq 31$ can be accessed by the program, but they are not significant and their value is ignored by the communicator.

3.2-5 32-channel Output Module

- **170 ADO 350 00**

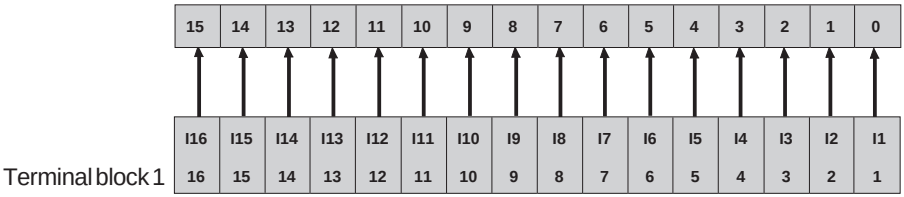
The image of the output channels is sent to the communicator using : %Q\p.2.c\0.i,
i varies according to the following rule :



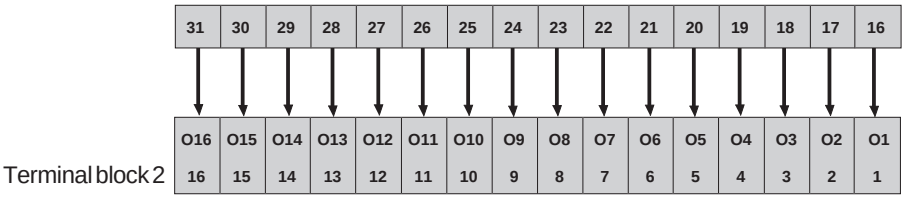
3.2-6 Mixed I/O Modules

- **170 ADM 350 10** (16 inputs and 16 outputs)

The image of the input channels can be accessed using : %I\p.2.c\0.i,
i varies according to the following rule :

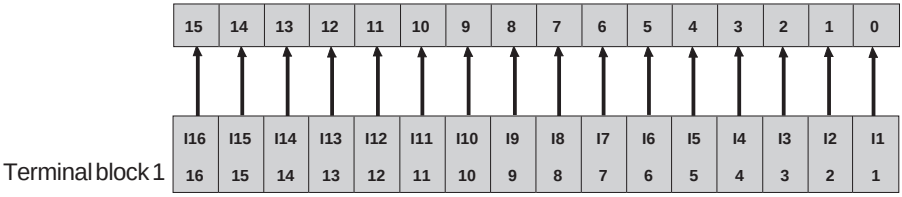


The image of the output channels is sent to the communicator using: %Q\p.2.c\0.i,
i varies according to the following rule :

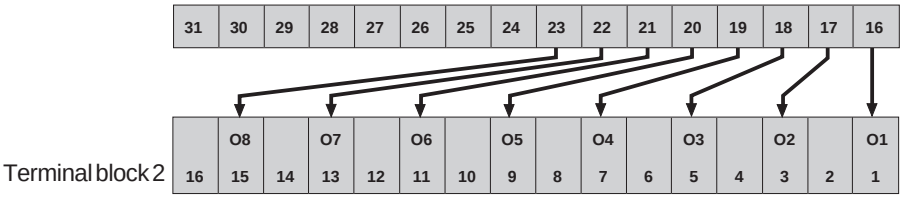


- **170 ADM 370 10** (16 inputs and 8 outputs)

The image of the input channels can be accessed using : %I\p.2.c\0.i,
i varies according to the following rule :



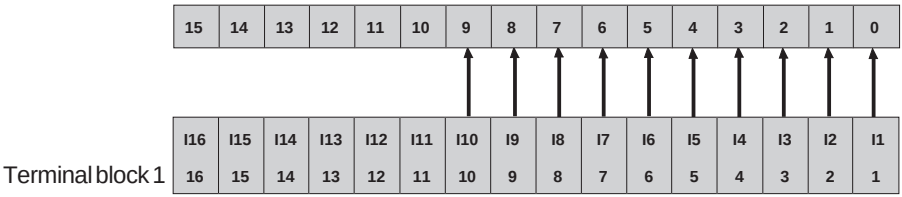
The image of the output channels is sent to the communicator using : %Q\p.2.c\0.i,
i varies according to the following rule :



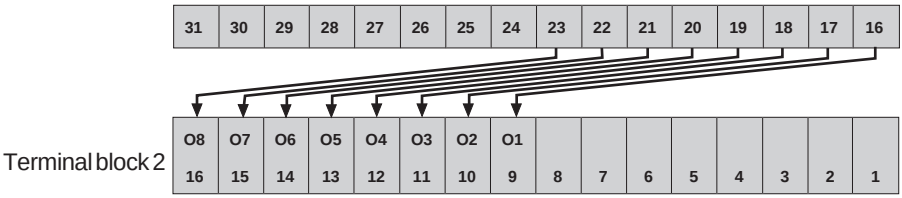
The bits of word %Q\p.2.c\0.i, $24 \leq i \leq 31$ can be accessed by the program, but they are not significant and their value is ignored by the communicator.

- **170 ADM 390 30** (10 inputs and 8 outputs)

The image of the input channels can be accessed using : %I\p.2.c\0.i,
i varies according to the following rule :



The image of the output channels is sent to the communicator using : %Q\p.2.c\0.i,
i varies according to the following rule :



The bits of word %Q\p.2.c\0.i, $24 \leq i \leq 31$ can be accessed by the program, but they are not significant and their value is ignored by the communicator.

3.3 Analog Modules

The analog input and output values are read or written to a word. The sign is always assigned to bit 15. The value is justified to the left. The representation format is two's complement binary.
Representation for the inputs :

%IW\p.2.c\0.0

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
sgn	Value of input 1														

%IW\p.2.c\0.n

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
sgn	Value of input n														

Representation for the outputs :

%QW\p.2.c\0.0

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
sgn	Value of output 1														

%QW\p.2.c\0.n

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
sgn	Value of output n														

The value n for exchanges with PL7 is equivalent to n+1 in the module

The analog modules in the PL7 catalog are :

- **170 AAI 030 00** (8 analog inputs)
- **170 AAI 140 00** (16 analog inputs)
- **170 AAI 520 40** (4 thermocouple or temperature probe inputs, ± 25mV or ± 100mV)
- **170 AAO 120 00** (4 outputs ± 10V, 0...20mA)
- **170 AAO 921 00** (4 outputs ± 10V, 4...20mA)
- **170 AMM 090 00** (4 analog inputs / 2 analog outputs and 4 discrete inputs / 2 discrete outputs)

Functional parameters can be assigned to each analog module. These parameters can be initialized via the program. These may be adjustment parameters, functional parameters, conversion parameters, etc.
They are transmitted to the module via the communicator in the form of words.

Any parameter value other than those shown in the tables below is prohibited. The module continues to operate with the last valid parameters it has received.

170 AAI 140 00 : (16 analog inputs)
Acquisition of the value of the input channels :
%IW\p.2.c\0.0.0 to %IW\p.2.c\0.0.15

Writing the channel parameters :
Each 4-bit byte corresponds to an analog channel.
The order of the 4-bit bytes is as follows :

%MW\p.2.c\0.0.20

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
channel 4				channel 3				channel 2				channel 1			

%MW\p.2.c\0.0.21

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
channel 8				channel 7				channel 6				channel 5			

%MW\p.2.c\0.0.22

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
channel 12				channel 11				channel 10				channel 9			

%MW\p.2.c\0.0.23

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
channel 16				channel 15				channel 14				channel 13			

The value of each 4-bit byte is coded according to the following rules :

bits of a 4-bit byte 3 2 1 0	hex. value	significance
0 0 0 0	0	reserved
1 0 1 0	A	+/- 5VDC
1 0 1 1	B	+/- 10VDC
1 1 0 0	C	inactive channel
1 1 1 0	E	4 ... 20 mA

- **170 AAI 030 00 :** (8 analog inputs)

Acquisition of the value of the inputs :
%IW\p.2.c\0.0.0 to %IW\p.2.c\0.0.7

Writing the channel parameters :
Each 4-bit byte corresponds to an analog channel.
The order of the 4-bit bytes is as follows :

	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
%MW\p.2.c\0.0.4	channel 4				channel 3				channel 2				channel 1			
%MW\p.2.c\0.0.5	channel 8				channel 7				channel 6				channel 5			

The value of each 4-bit byte is coded according to the following rules :

bits of a 4-bit byte 3 2 1 0	hex. value	significance
0 0 0 0	0	reserved
0 0 1 0	2	+/- 5VDC and +/- 20mA
0 0 1 1	3	+/- 10VDC
0 1 0 0	4	inactive channel
1 0 0 1	9	1...5VDC and 4 ... 20 mA

- **170 AAI 520 40** (4 analog inputs TS, TC, Mv)

Acquisition of the value of the input channels :
%IW\p.2.c\0.0.0 to %IW\p.2.c\0.0.3

Writing the channel parameters :
The parameters of each analog channel must be coded on 16 bits (1 word).
The parameter corresponds to : the type of sensor, the choice of the unit of temperature, the requirement for a wiring check.

	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
%MW\p.2.c\0.0.4 to %MW\p.2.c\0.0.5	Channel parameters															

The following tables give the value of the parameter to be written for a channel according to the sensor and functions required.

• **170 AAI 520 40** (continued)

Writing the channel parameters :

Type of sensor	Unit of temperature	Wiring check	parameter word (hex)
Thermocouple B	1/10°C	inactive active	2201 2301
	1/10°F	inactive active	2281 2381
Thermocouple E	1/10°C	inactive active	1202 1302
	1/10°F	inactive active	1282 1382
Thermocouple J	1/10°C	inactive active	1203 1303
	1/10°F	inactive active	1283 1383
Thermocouple K	1/10°C	inactive active	1204 1304
	1/10°F	inactive active	1284 1384
Thermocouple N	1/10°C	inactive active	1205 1305
	1/10°F	inactive active	1285 1385
Thermocouple R	1/10°C	inactive active	2206 2306
	1/10°F	inactive active	2286 2386
Thermocouple S	1/10°C	inactive active	2207 2307
	1/10°F	inactive active	2287 2387
Thermocouple T	1/10°C	inactive active	2208 2308
	1/10°F	inactive active	2288 2388

The table is continued on the next page.

table continued from the previous page

Type of sensor	Wiring configuration	Unit of temperature	Wiring check	parameter word (hex)
IEC PT 100 RTD	2 or 4 wire	1/10°C	inactive active	0A20 0B20
		1/10°F	inactive active	0AA0 0BA0
	3-wire	1/10°C	inactive active	0E20 0F20
		1/10°F	inactive active	0EA0 0FA0
IEC PT 1000 RTD	2 or 4 wire	1/10°C	inactive active	0221 0321
		1/10°F	inactive active	02A1 03A1
	3-wire	1/10°C	inactive active	0621 0721
		1/10°F	inactive active	06A1 07A1
US/JIS PT 100 RTD	2 or 4 wire	1/10°C	inactive active	0A60 0B60
		1/10°F	inactive active	0AE0 0BE0
	3-wire	1/10°C	inactive active	0E60 0F60
		1/10°F	inactive active	0EE0 0FE0
US/JIS PT 1000 RTD	2 or 4 wire	1/10°C	inactive active	0261 0361
		1/10°F	inactive active	02E1 03E1
	3-wire	1/10°C	inactive active	0661 0761
		1/10°F	inactive active	06E1 07E1

table continued from the previous page

Type of sensor	Wiring configuration	Unit of temperature	Wiring check	parameter word (hex)
DIN Ni 100 RTD	2 or 4-wire	1/10°C	inactive active	0A23 0B23
		1/10°F	inactive active	0AA3 0BA3
	3-wire	1/10°C	inactive active	0E23 0F23
		1/10°F	inactive active	0EA3 0FA3
DIN Ni 1000 RTD	2 or 4-wire	1/10°C	inactive active	0222 0322
		1/10°F	inactive active	02A2 03A2
	3-wire	1/10°C	inactive active	0622 0722
		1/10°F	inactive active	06A2 07A2

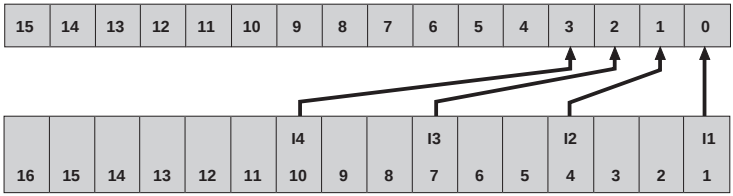
Type of sensor	Wiring check	parameter word (hex)
+/- 25 mV	inactive active	2210 2310
+/- 100 mV	inactive active	1211 1311

- **170 AAM 090 00** (4 analog inputs / 2 analog outputs and 4 discrete inputs / 2 discrete outputs)

This is a mixed module. It has both analog and discrete channels.
The topology and exchange syntax of these discrete I/O are as follows :

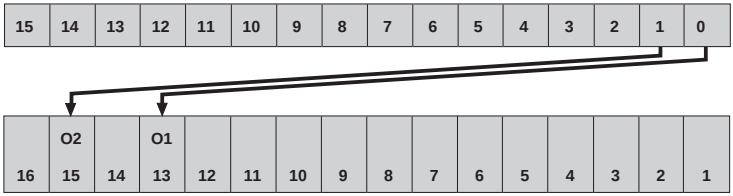
Discrete inputs :

%IW\p.2.c\0.4



Discrete outputs :

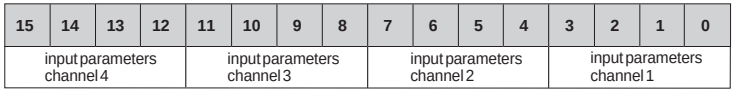
%QW\p.2.c\0.2



Access to the analog channels :
Inputs : %IW\p.2.c\0.0.0 to %IW\p.2.c\0.0.3
Outputs : %QW\p.2.c\0.0.0 to %QW\p.2.c\0.0.1

Writing the input channel parameters :
Each 4-bit byte corresponds to an analog channel.
The order of the 4-bit bytes is as follows :

%MW\p.2.c\0.0.4



Writing the analog input channel parameters :

The value of each 4-bit byte is coded according to the following rules :

bits of a 4-bit byte 3 2 1 0	hex. value	significance
0 0 0 0	0	reserved
0 0 1 0	2	+/- 5V or +/- 20 mA
0 0 1 1	3	+/- 10VDC
0 1 0 0	4	inactive channel
1 0 1 0	A	1 ... 5V or 4 ... 20 mA

Writing the analog output channel parameters :
The first two 4-bit bytes correspond to the two output channels

%MW\p.2.c\0.0.4

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
reserved				reserved				output parameters channel 2				output parameters channel 1			

The value of each 4-bit byte is coded according to the following rules :

bits of a 4-bit byte 3 2 1 0	hex. value	fallback behavior
0 0 0 0	0	reserved
0 0 x 1	1 or 3	0 mA and 0V
0 1 x 1	5 or 7	20 mA and 10V
1 0 x 1	9 or B	maintain

x : either 0 or 1

- **170 AAO 120 00** (4 analog outputs 0-20mA or 0-10V)

Writing the value of the outputs :

%QW\p.2.c\0.0.0
to
%QW\p.2.c\0.0.3

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
sgn	Value of the output														

Writing the output channel parameters :
The 4-bit bytes correspond to each of the analog output channels.

%MW\p.2.c\0.0.4

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
output parameters channel 4				output parameters channel 3				output parameters channel 2				output parameters channel 1			

The value of each 4-bit byte is coded according to the following rules :

bits of a 4-bit byte 3 2 1 0	hex. value	fallback behavior
0 0 0 0	0	reserved
0 0 x 1	1 or 3	0 mA and 0V
0 1 x 1	5 or 7	20 mA and 10V
1 0 x 1	9 or B	maintain

x : either 0 or 1

- **170 AAO 921 00** (4 analog outputs 4-20mA or 0-10V)

Writing the value of the outputs :

%QW\p.2.c\0.0.0
to
%QW\p.2.c\0.0.3

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
sgn	Value of the output														

Writing the output channel parameters :
The 4-bit bytes correspond to each of the analog output channels.

%MW\p.2.c\0.0.4

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
output parameters channel 4				output parameters channel 3				output parameters channel 2				output parameters channel 1			

The value of each 4-bit byte is coded according to the following rules :

bits of a 4-bit byte 3 2 1 0	hex. value	fallback behavior
0 0 0 0	0	reserved
0 0 x 1	1 or 3	4 mA or 0V
0 1 x 1	5 or 7	20 mA or 10V
1 0 x 1	9 or B	maintain

x : either 0 or 1

Symbols

A

C

D

G

I

M

O

P

S