



DIGITAL INPUT / OUTPUT TRANSMITTER

PD 1331

MANUAL



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1. General information.

PD 1331 digital I/O is a module in **Proces-Data's** module series 1000. The PD 1331 module is designed for controlling and supervision of valves, relays, motors etc. The module is provided with 16 input/output-channels and 8 input-channels. A microprocessor controls and supervises all the functions.

The module requires a power supply of 24 V AC, +/- 15%.

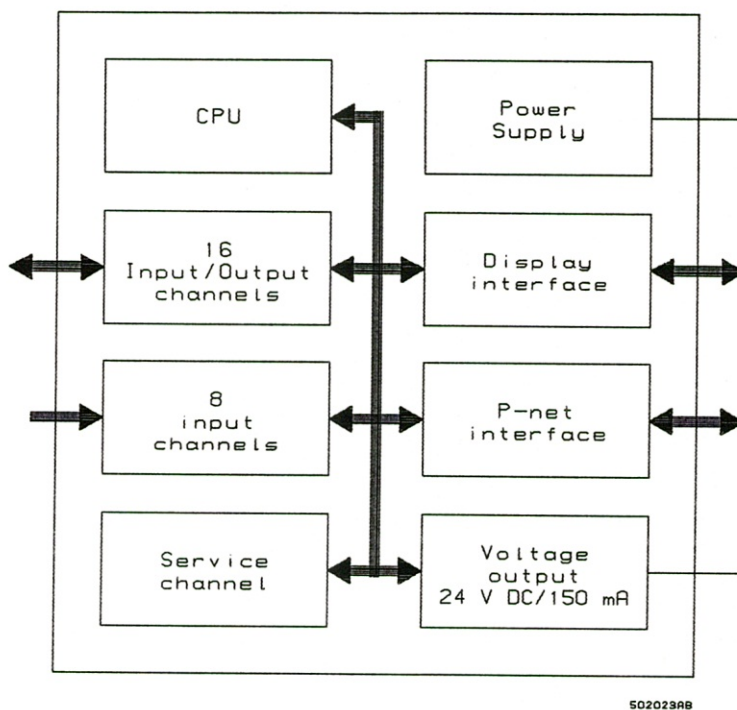
Maximum total power consumption is 4 A.

The P-net connection is galvanically separated from the rest of the module.

1.1. Functions.

- * Direct connection of 24 V-equipment (relays, valves etc) with a power consumption of 350 mA (8 VA) on up to 16 outputs. (The total power consumption must not exceed 4 A).
- * Automatic check of connections between module and peripheral equipment.
- * Automatic check of double feed-back signal with adjustable delay from up to 8 outputs.
- * Automatic check of single feed-back signal with adjustable delay from up to 12 outputs.
- * Measuring of frequency, sec/cycle or RPM on 1 output. (Max. 250 Hz).
- * Counting pulses on 8 inputs. (Max. 250 Hz).
- * Various automatic controls on up to 16 outputs.
- * Direct connection of the display-unit PD 230. The PD 230 is used for reading out and preset of the 8 counter registers on the input-channels and for reading out of frequency, sec/cycle or RPM.
- * Connection to **Proces-Data's** L.A.N. - the P-net. Selection of functions, preset of counters, set/reset of outputs and test of inputs and feed-back signals may be carried out via the P-net.
- * Voltage output. (24 V, max. 150 mA).
- * Overload protection on all input/output-channels.
- * Bounce limiter on 1, 7 or 8 inputs. 1.2. PD 1331, block diagram.

1.2. PD 1331, block diagram.



1.3. P-net connection.

The PD 1331 module works in **Proces-Data's** L.A.N. - the P-net, which is a local area network designed for process control and data acquisition.

The outputs of the PD 1331 module are controlled via the P-net. Selection of the desired functions as well as all communication with peripherally equipment takes place on the P-net.

A typical application using the P-net would be a system where a computer retrieves measurement results from one or several modules for display on a data screen. From the computer the operator can control outputs (digital as well as analog) and test the connected modules for errors (internal as well as external).

Further information about the P-net in "P-net, Manual" or from **Proces-Data**.

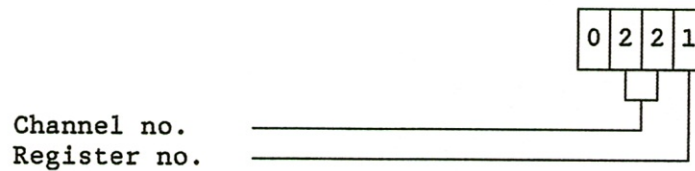
2. Channels / registers.

The PD 1331 module contains 25 channels:

1 service channel	(channel 0)
16 input/output-channels	(channel 10-17 and 20-27)
8 input-channels	(channel 30-37)

Each channel has a set of 16 registers numbered from 0 to F (see the table below). When addressing one particular register an address of four hexadecimal figures is used.

Example: Register 1 on channel 22 must be addressed. The address is set up like this:



Attempts to read out non-defined registers will cause no reply. The computer will react to such an attempt in the same way as it will to errors in P-net transmission.

Throughout the manual the register sets will be visualized in a table. The example on the next page concerns the registers on the service channel, channel 0.

Reg.no	Contents	Write	Storage medium	Number of bytes	Read-out
0					
1	DeviceType		P	2	Decimal
2	ProgVers		P	2	Decimal
3	Error3		R	1	Hexadec.
4					
5					
6					
7	WDTimer	X	R	2	Decimal
8	WDPreSet	(X)	E	2	Decimal
9	Code9	(X)	E	4	Hexadec.
A					
B					
C					
D					
E					
F	CHError		R	1	Hexadec.

Storage mediums: R: RAM, E: EEPROM, P: PROM.

* Data stored in EEPROM can only be altered when the Programme Enable switch (see paragraph 8.) is in ON position.

2.1. Input-channels (channel 30-37).

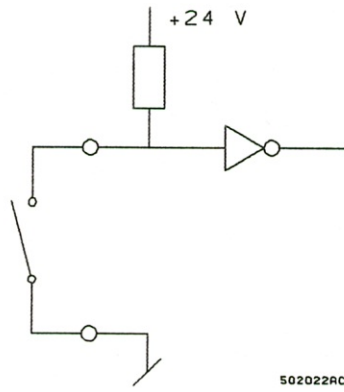


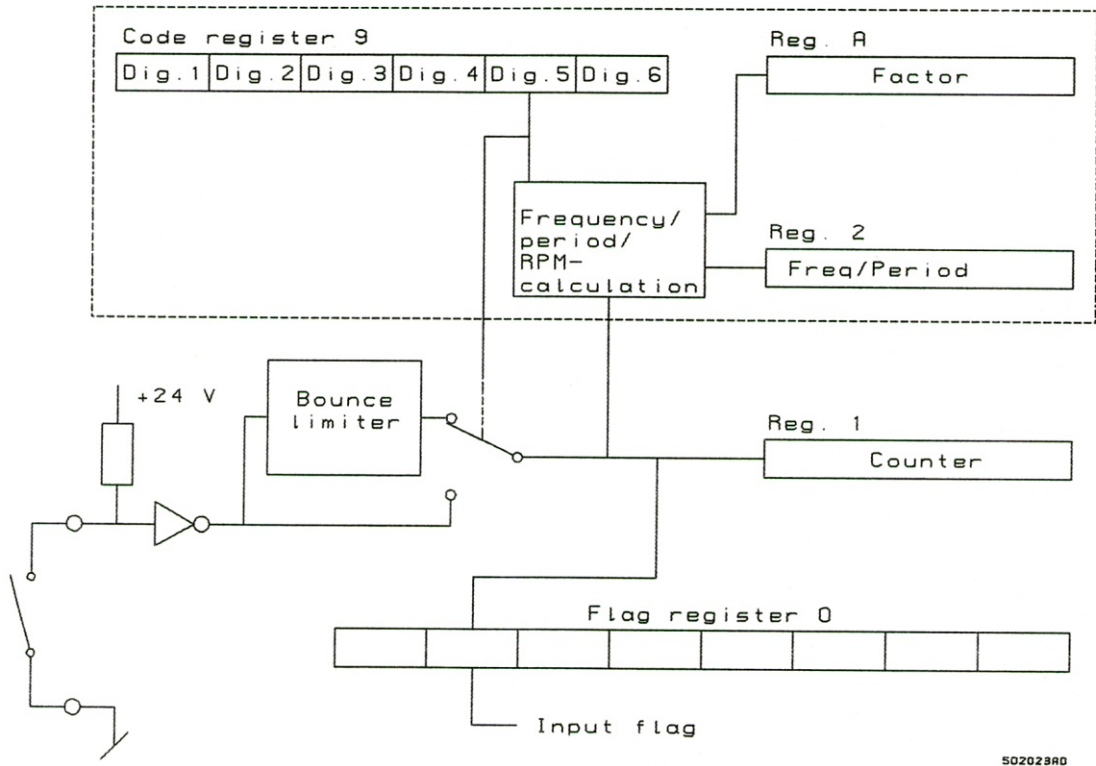
Fig. 2.1.a.: Input-channel, schematic

When the contact is closed logic "1" is detected.

When the contact is open logic "0" is detected.

The input-channels may also be used for counting pulses.

2.1.1. Block diagram showing input-channel.



In addition to the normal input functions channel 30 includes facilities for measuring of frequency and sec/cycle (or RPM), control of the bounce limiter function and furthermore channel 30 is used for selecting register and decimal point when reading out on the display.

2.1.2. Registers on input-channels (channel 30-37).

For each input-channel 3 registers are defined. (For channel 30 three registers).

Reg. no	Contents	Write	Storage medium	Number of bytes	Read out	Channel	
0	FlagReg Counter	X	R	1	Binary Decimal	31-37	
1			R	2		31-37	
2							
3							
4							
5							
6							
7							
8							
9							
A	CHError		R	1	Hexadec.	31-37	
B							
C							
D							
E							
F							

Reg. no	Contents	Write	Storage medium	Number of bytes	Read out	Channel
0	FlagReg Counter	X	R	1	Binary Decimal Decimal	30
1			R	2		30
2			R	4		30
3						
4	Code9 Scale	X	E	4	Hexadec. Decimal	30
5						
6						
7						
8						
9	CHError		R	1	Hexadec.	30
A						
B						
C						
D						
E						
F						

Reg. 0: FlagReg.

The flags 0 to 5 and flag 7 are not used.

Flag 6: InFlag.

The InFlag will show the logic level on input. If the logic level is "1", the InFlag is set. If the logic level is "0", the flag is reset.

Reg. 1: Counter.

The counter counts the number of pulses on input. The pulse frequency should not exceed 250 Hz. The greatest figure the counter can contain is 65535 (2 bytes). When the counter reaches its maximum value it starts from 0 again.

There is no automatic preset of the counter. When necessary, the counter must be preset via the P-net or the display-unit.

The counter counts on negative edges.

Reg. 2: Freq/Period (channel 30 only).

Frequency or sec/cycle are measured on channel 30. The pulse frequency must be in the interval 0.1 to 250 Hz. (If the pulse frequency is below 0.1 Hz the "calculated" value will be 0). New values are calculated every 2nd second unless the pulse frequency is below 0,5 Hz. In this case the intervals between the pulses are measured and the frequency is calculated from this value. The resolution on the measurement is approx. 0.1%.

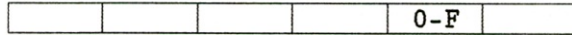
The desired function (frequency or seconds/cycle) is selected by means of code register 9.

Conversion from frequency to RPM: see register A.

Reg. 9 (channel 30): Code9.

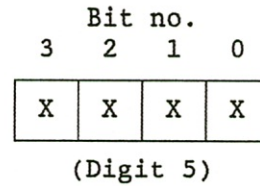
The code consists of 6 digits. Only digit 5 and 6 are used.

Dig.5:



Various functions.
See following pages.

The code inserted in digit 5 is made up from 4 bits controlling 4 different functions. The code to be inserted is calculated by adding up the weights of the desired functions.



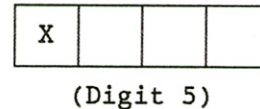
The result must be stated in hexadecimal figure.

Bit	Weight
3	8
2	4
1	2
0	1

A combination of bit 3 and bit 2 would be $8 + 4 = 12$. Converted to hexadecimal representation the code to be inserted would be "C".

Bit 3: Bounce limiter, channel 31-37.

This function will remove rebound from channel 31-37. Rebound on the inputs may last up to 10 ms. The frequency on the inputs must not exceed 25 Hz when this function is on.

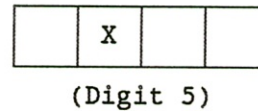


Bit 3 = 0: Bounce-limiter off.
Bit 3 = 1: Bounce-limiter on.

Bit 2: Bounce-limiter, channel 30.

This function will remove rebound from channel 30.

When bounce-limiter is off, minimum on/off time is 2 ms.

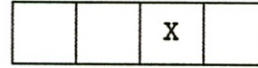


When bounce-limiter is on, minimum on/off time is 20 ms.



Bit 1: Freq/period.

This bit controls whether channel 30 is measuring frequency or sec./cycle. When measuring frequency the result may be converted to RPM by inserting a sufficient factor in Reg. 30A.

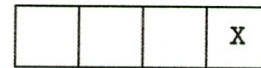


(Digit 5)

- Bit 1 = 0: Frequency
- Bit 1 = 1: Period

Bit 0: Data to display.

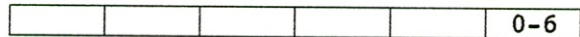
This bit controls which register to be read out on the display unit. It could be the register containing frequency or sec./cycle or it could be the counter register.



(Digit 5)

- Bit 0 = 0: Counter
- Bit 0 = 1: Frequency/period

Dig.6: Number of digits after decimal point



When reading out frequency or sec/cycle on the display unit the number of digits after the decimal point may be fixed.

This facility has no function when reading out from counters.

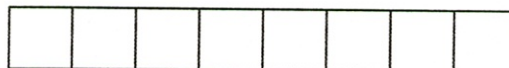
The number of digits may be selected from 0 to 6.

Reg. A: Scale (channel 30 only).

The contents of register 2 is always multiplied by the factor inserted in register A. If no conversion is needed insert "1". If a conversion from frequency to RPM is needed the factor must be 60 (if the pulsator produces 1 pulse per rotation!).

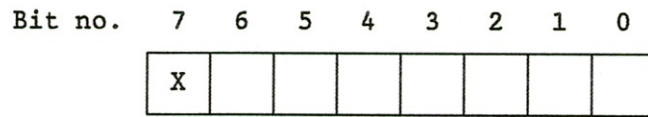
Reg. F: CError.

Bit no. 7 6 5 4 3 2 1 0



If there is an error in the module which may cause an error on the specific channel, bit no. 7 in this register will be set.

Bit 7: Module error.



See paragraph 5.1. for further information.

2.1.3. Testing condition on external contacts.

This function requires an input-channel (30-37).

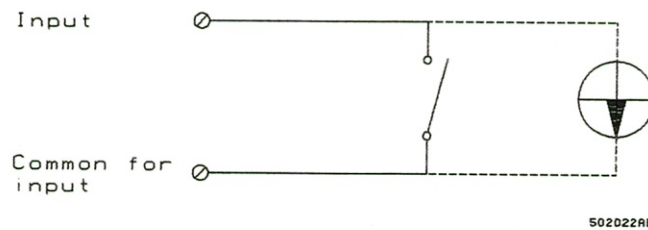
Function:

The condition of the switch (mechanical or semi-conductor) is shown in flag 2 in the flag register for the chosen input-channel (Reg. 0).

With closed contact (logic "1") the InFlag is set.

With open contact (logic "0") the InFlag is reset.

Connection to terminal strip:



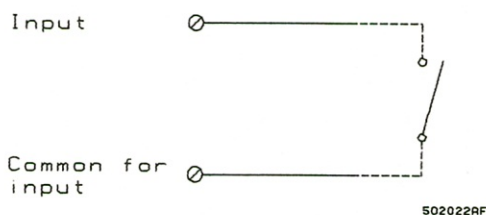
2.1.4. Counting pulses on input.

Any of the input-channels (30-37) may be used.

Function:

The counter is incremented by 1 each time the contact on the input changes from closed to open.

Connection to terminal strip:



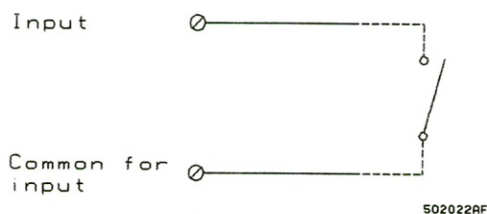
Setting of the module:

Code9 for the chosen input-channel is set (via P-net) as explained in paragraph 2.1.2 "Reg. 9: Code9" according to whether bounce limiter is needed or not.

2.1.5. Measuring frequency or sec per cycle with/without conversion to RPM and with/without rebound limiter.

Only input-channel no. 30 can be used.

Connection to terminal strip:



Setting of the module:

The code register for input-channel no. 30 is set (via P-net) as explained in paragraph 2.1.2. "Reg. 9: Code9"

2.2. Input/output-channels (10 to 17 and 20 to 27).

The PD 1331 module has 16 I/O-channels which can be used either as inputs or outputs. Each channel consists of a triac with overload protection and an internal pull-up resistor.

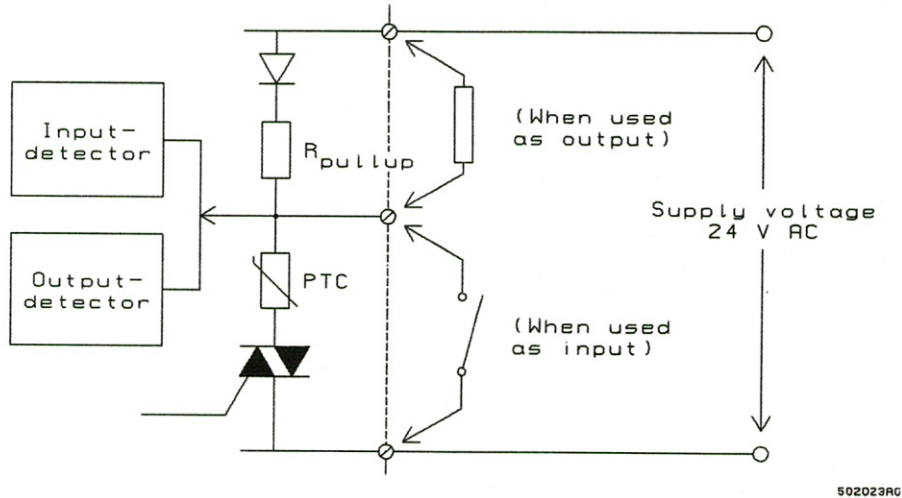


Fig.2.2.a.: Simplified diagram over I/O-channel

When the channel is used as input the triac is always closed.

When the input contact is open the logic level is "0".
When the input contact is closed the logic level is "1".

When the channel is used as output:

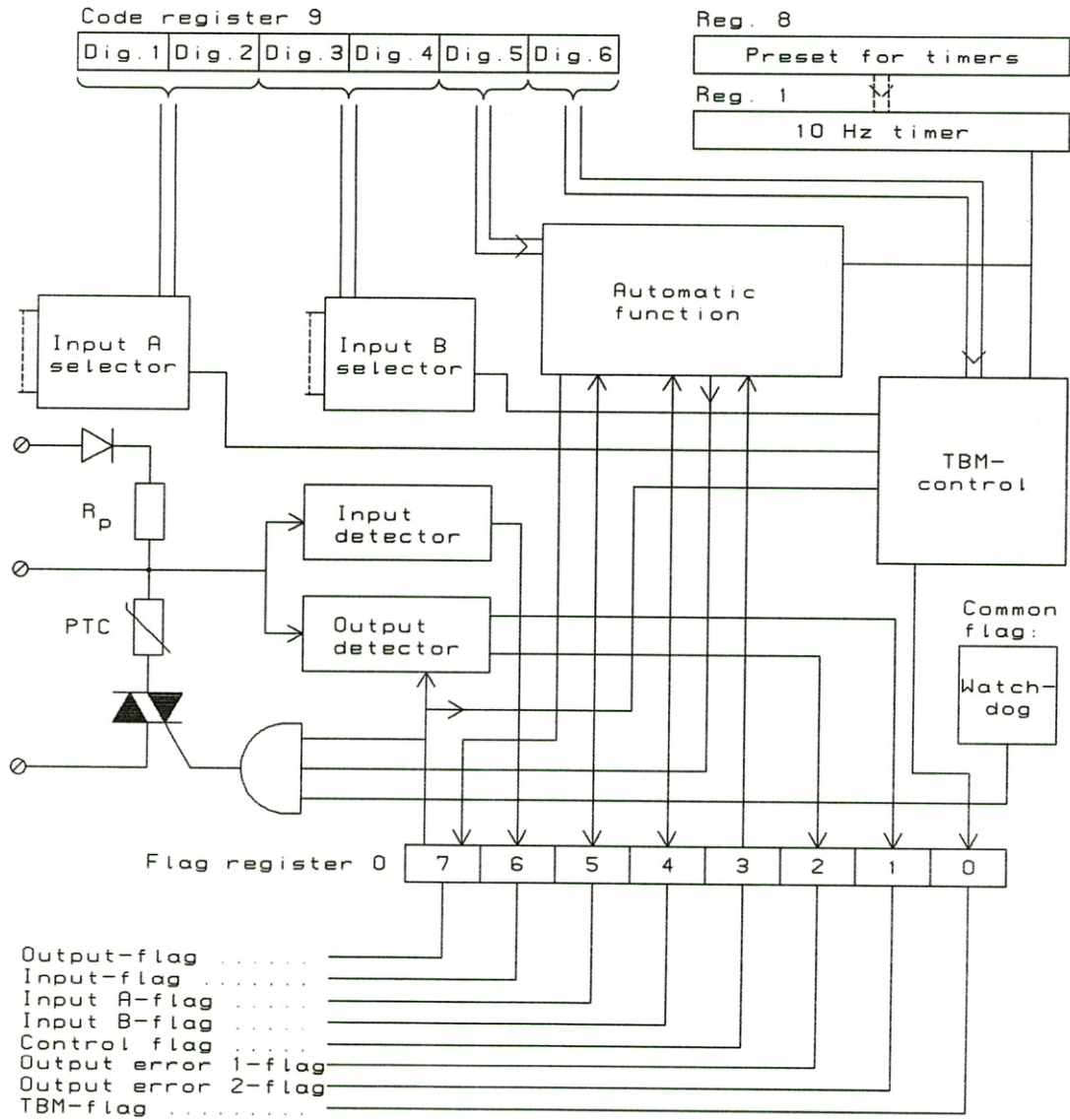
OutFlag = "0": triac off.
OutFlag = "1": triac on.

The current through the load passes the PTC resistor and the triac. If the load is greater than 350 mA the PTC will limit the current. The PTC will open again if the output is reset or if the load is removed for 10 seconds.

The output detector will detect overload, missing load or triac error.

The 16 I/O-channel may be set up with internal automatic. The automatic works on output as well as input.

2.2.1. Block diagram over I/O channel.



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2.2.2. Registers on I/O-channels.

The 16 input/output-channels are referred to as I/O 10-17 and I/O 20-27. For each channel 5 registers are defined.

Reg.no	Contents	Write	Storage medium	Number of bytes	Read-out
0	FlagReg	X	R	1	Binary
1	IOTimer	X	R	2	Decimal
2					
3					
4					
5					
6					
7					
8	IOPreset	(X)	E	2	Decimal
9	Code9	(X)	E	4	Hexadec.
A					
B					
C					
D					
E					
F	CHError		R	1	Hexadec.

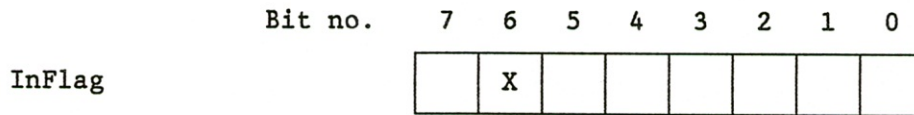
Reg. 0: FlagReg.

	Bit no.	7	6	5	4	3	2	1	0
OutFlag		X							

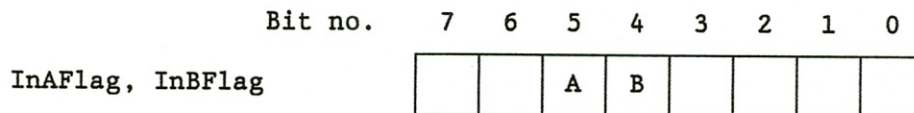
This flag controls the output if the watch-dog flag is set and the channel is used as output. If an automatic function is on this will influence on the output flag in the same way as P-net transmission.

OutFlag = "0": triac off

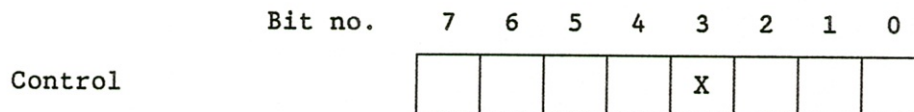
OutFlag = "1": triac on



The InFlag is controlled by the input detector and shows the logic level on the input terminals. If the channel is used as output the InFlag will follow the output flag with a delay of 100 ms. If the input terminals are short-circuited or disconnected the InFlag will not follow the output flag.

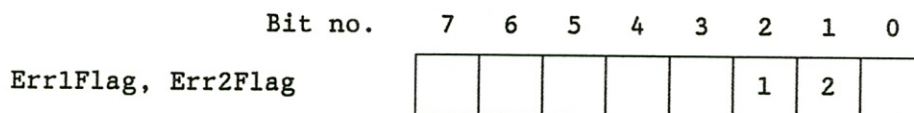


Some of the functions require - in excess of the output - one or two inputs (e.g. double feed-back signal). Input A flag is input flag for the channel chosen for channel A. The channel number is inserted in the code register in digit number 1 and 2. Input B flag is input flag for the channel inserted in digit 3 and 4 in the code register.



When the Control flag is set the automatic function chosen for the I/O-channel is on. When the Control flag is reset the output is reset and the automatic function is cut off (except the feed-back signal) and the output may be controlled as usual.

When starting up the Control flag is reset.



The output detector supervises the output and compares the output signal to the output flag. The two flags are generated from this comparison. The flags must be compared with the output flag to make sense.

Output	Output error		Fault type
	1	2	
0	0	0	OK
0	0	1	Triac partly short-circuited
0	1	0	Load disconnected / triac partly short-circuited
0	1	1	Load bad connected / triac short circuited
1	0	0	OK
1	0	1	Triac partly disconnected
1	1	0	Triac partly disconnected
1	1	1	Over load / triac disconnected

	Bit no.	7	6	5	4	3	2	1	0
Feedback error flag		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

If the feed-back system is on this flag will indicate if there is a feed-back error.

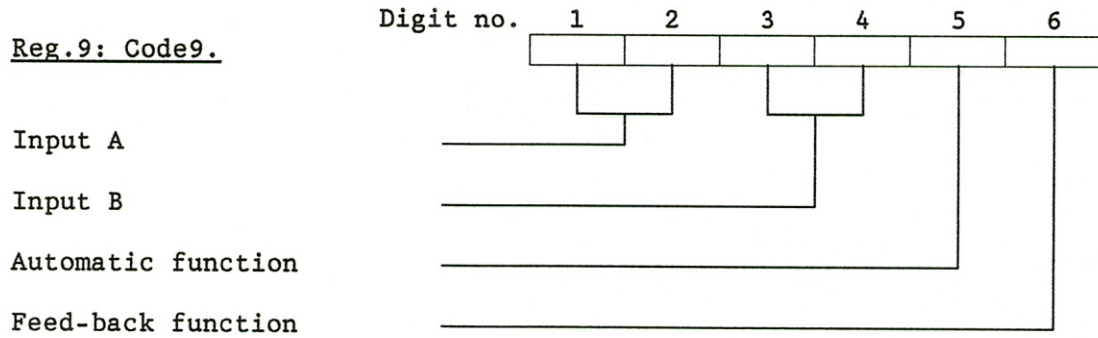
Feed-back error flag = "1": feed-back error.

Reg. 1: IOTimer.

Each I/O-channel has a timer used for the automatic functions. The timer counts down at a frequency of 10 Hz (maximum time approx. 1 h 30 min) until it reaches 0. The timer is preset either via P-net or from the preset register depending on which function is chosen for the I/O-channel.

Reg. 8: IOPreset

This register contains a preset value for the timer.

Reg.9: Code9.Input A / Input B.

The automatic functions for output require 1 or 2 input signals. The channel numbers of the input-channels, called Input A and Input B, must be inserted in code register 9.

The channel number of input A is inserted in digit 1 and 2.
The channel number of input B is inserted in digit 3 and 4.

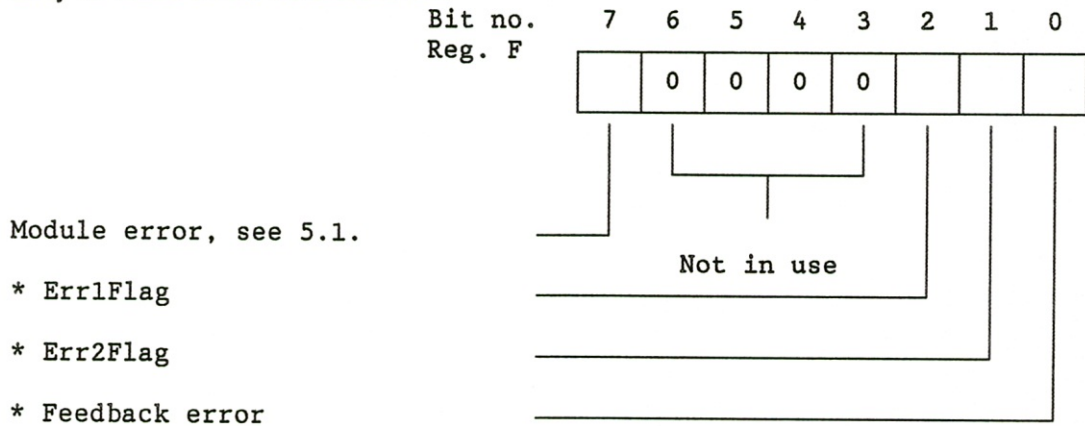
Automatic function / feed-back function.

The choice of automatic function influence on which feedback functions that may be chosen. The possible combinations of feed-back functions and automatic functions are explained later on.

The automatic functions are switched on and off using the Control flag in FlagReg 0.

Reg. F: CHError.

CHError states instantaneous errors on the channel in question or errors on the module likely to cause errors on the channel.



* These flags are copies of the corresponding flags in flagregister 0.

2.2.3. I/O-channel used as input.

Testing conditions on pushbuttons, micro switches, semi-conductors etc.

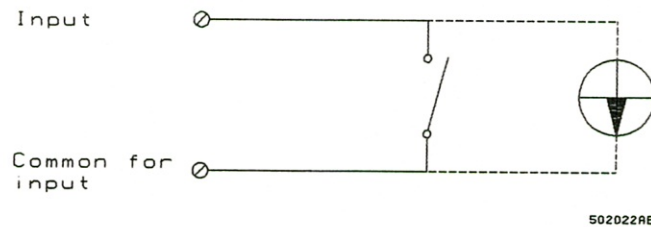
This function requires an I/O-channel (10-27).

Function:

The condition of the switch (mechanical or semi-conductor) is shown in the FlagReg of the chosen I/O-channel (Reg. 0).

With closed contact (logic "1") the InFlag is set.
With open contact (logic "0") the InFlag is reset.

Connection to terminal strip:



Setting of the module:

Code9 of the chosen I/O-channel is set (via P-net) as follows:

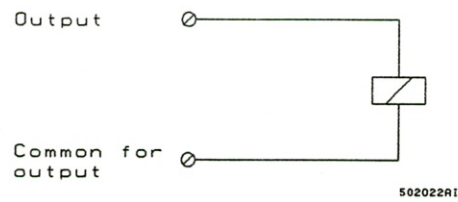
0	0	0	0	0	0	0
---	---	---	---	---	---	---

2.2.4. I/O-channel used as output.

All 16 outputs can control 24 V equipment (relays, valves etc) with a maximum power consumption of 350 mA (8 VA) on each channel. The total power consumption should not exceed 4 A.

The following functions require one I/O-channel (10-27).

Connection to terminal strip:



2.2.5. Output controlled via P-net.

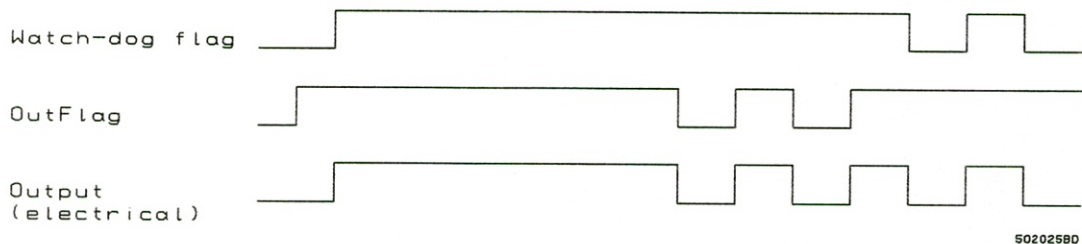
Function:

Output is controlled by the output flag in the FlagReg of the I/O-channel (Reg. 0). This flag is set/reset via P-net.

Output goes ON if output flag and watch-dog flag (see paragraph 2.2.1. and 5.) are set.

The output flag may be set/reset independent of the watch-dog flag. The output flag though, will be reset (output goes OFF) if the Control flag is reset - even if the Control flag is already reset.

Time schedule:



Setting of the module:

Without feed-back signal:

Code9 of the chosen I/O-channel (Reg. 9) is set (via P-net) as follows:

0	0	0	0	F	0
---	---	---	---	---	---

With feed-back signal:

See the paragraphs 3. to 3.3.1.

2.2.6. Output controlled by timer (pulse output).

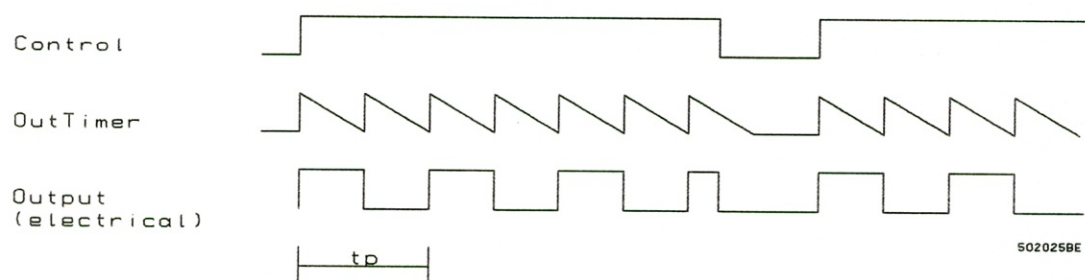
Function:

If the Control flag is set output will shift each time the IOTimer reaches 0. (The time for a period (t_p) is 2 times the contents of the IOPreset).

When the Control flag is reset, output is reset and may now be controlled via P-net. IOTimer runs even if the Control flag is reset but it is not reset when reaching 0.

When the Control flag is set output shifts immediately if IOTimer has reached 0. If not, output will not shift until it reaches 0. IOTimer may be set to 0 via P-net before the Control flag is set.

Time schedule:



Setting of the module:

Without feed-back signal:

The time for a period (t_p) is inserted in tenth of a second in IOPreset of the I/O-channel (Reg. 8).

Code9 of the I/O-channel is set (via P-net) as follows:

0	0	0	0	1	0
---	---	---	---	---	---

With feed-back signal:

See the paragraphs 3. to 3.3.1.

2.2.7. Output controlled by IOTimer (one shot).

Function:

If the Control flag is set, output will go ON each time the pulse length (tl) is inserted (via P-net) in IOTimer and OFF when the timer runs out.

If the Control flag is reset, output goes OFF and may now be controlled via P-net.

Time schedule:



502029Aa

Setting of the module:

Without feed-back signal:

The pulse length (tl) is inserted in IOTimer of the I/O-channel (Reg. 1).

Code9 of the I/O-channel is set (via P-net) as follows:

0	0	0	0	7	0
---	---	---	---	---	---

With feed-back signal:

See the paragraphs 3. to 3.3.1.

3. Feed-back signals.

The principle of the feed-back system is this:

If devices connected to the output do not respond within the available time, the feed-back error flag (FeedBackError) in flag register 0 is set.

The largest accepted delay in the connected devices can be either fixed (0.1 sec.) or adjustable.

Single or double feed-back signal may be chosen.

When using feed-back signal it is necessary to use one additional input-channel for each feed-back signal.

When using I/O-channels for handling feed-back signals it is important that the channels are set for this function. This is done by inserting "0" in all 6 digits in the code register.

The setting of Code9 for the output-channel depends on what type of contacts are used.

When using **normally-open contacts** (open when unactuated) the channel number of the input-channel is inserted in the code register in **digit 1 and 2** (channel A). In the following this type of contact will be called NO.

When using **normally-closed contacts** (closed when unactuated) insert in **digit 3 and 4** (channel B). In the following this type of contact will be called NC.

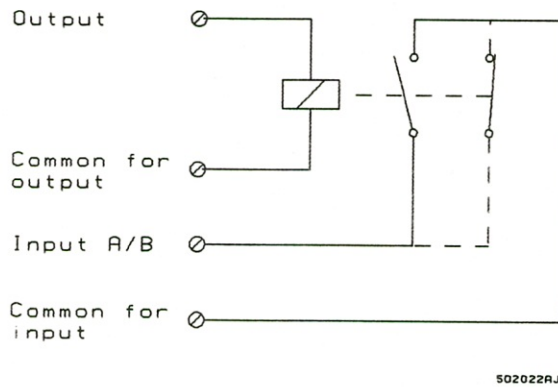
3.1. Single feed-back signal with fixed delay (0.1 sec).

The use of single feed-back signal requires one additional inputchannel which can be either an I/O-channel (10-27) set to input or a input-channel (30-37).

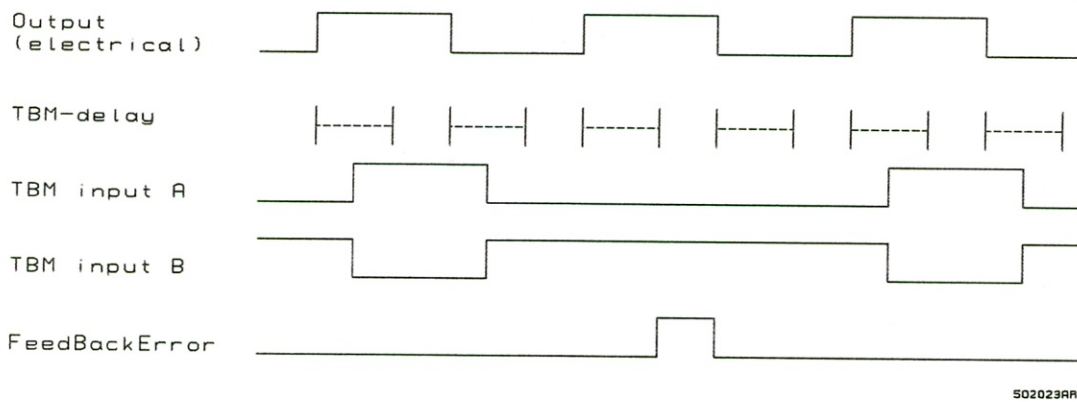
Function:

When output shifts, input must shift within 0.1 sec. If this doesn't happen, the FeedBackError in the FlagReg of the outputchannel (Reg. 0) is set.

Connection to terminal strip:

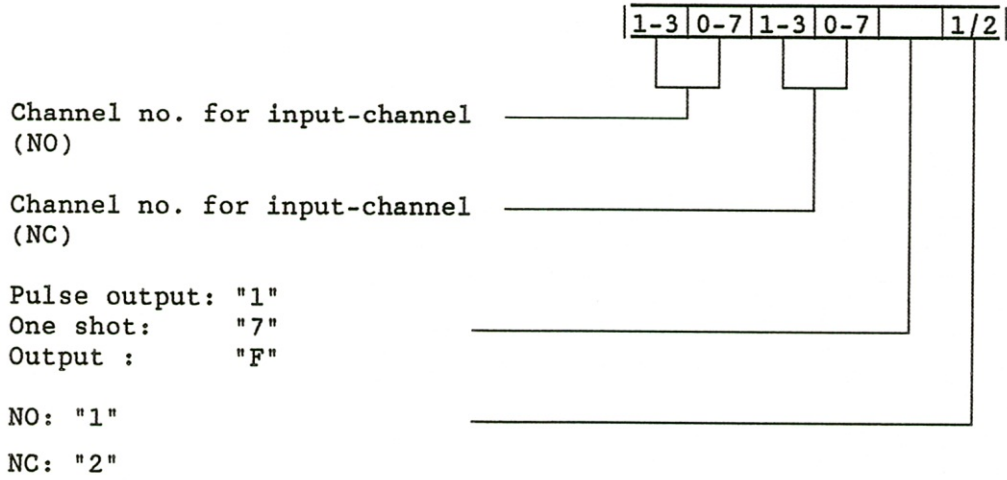


Time schedule:



3.1.1. Single FB-signal used with output/pulse, output/one shot.

Output-function, FB-function and the channel-number of the inputchannel are inserted (via P-net) in Code9 of the output-channel (Reg. 9).



3.2. Single feed-back signal with adjustable delay.

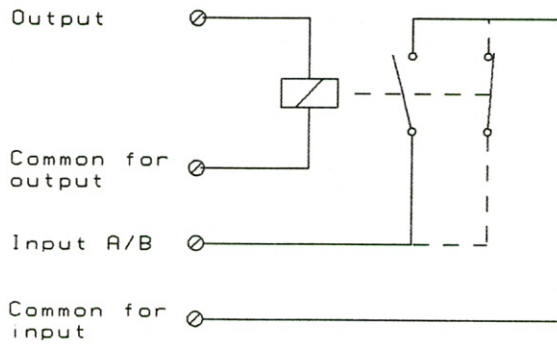
This FB-function requires one additional input.

Function:

When output shifts, input must shift within the time $t_{d \max}$. If this doesn't happen the FeedBackError flag in the flag register of the output-channel (Reg. 0) is set.

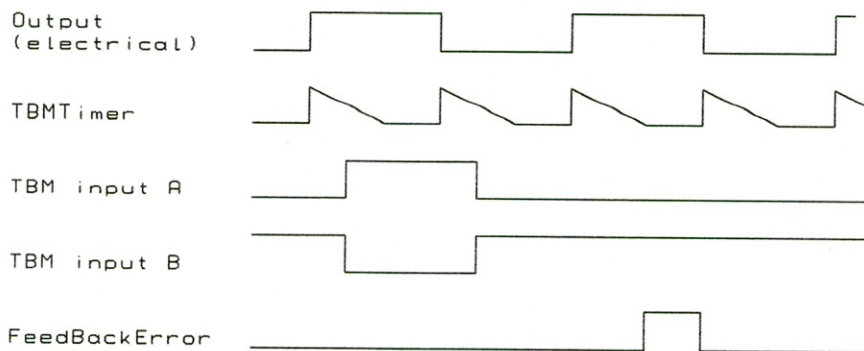
The largest tolerated delay of the FB-signal ($t_{d \max}$) is inserted in IOPreset of the output-channel (Reg. 8).

Connection to terminal strip:



502022AJ

Time schedule:



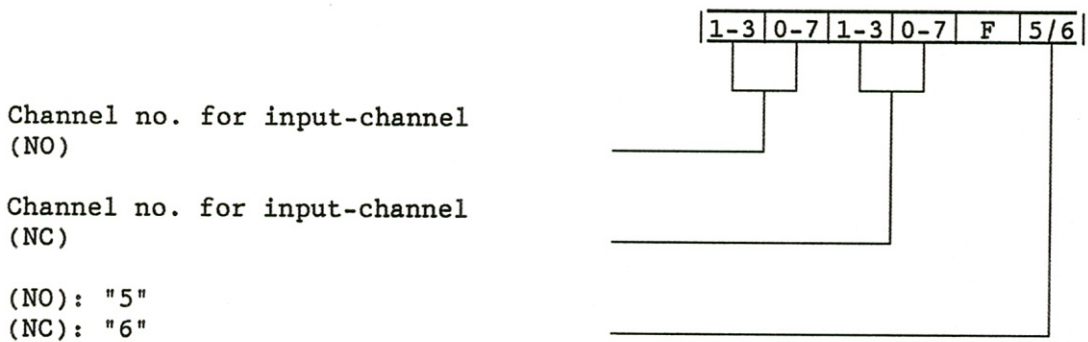
502025BF

3.2.1. Single FB-signal (adjustable delay) output/pulse output/one shot.

Used with output:

Choice of additional input-channel is arbitrary (10-37).

Output-function, FB-function and the channel number of the input- channel are inserted in Code9 of the output-channel (Reg. 9).

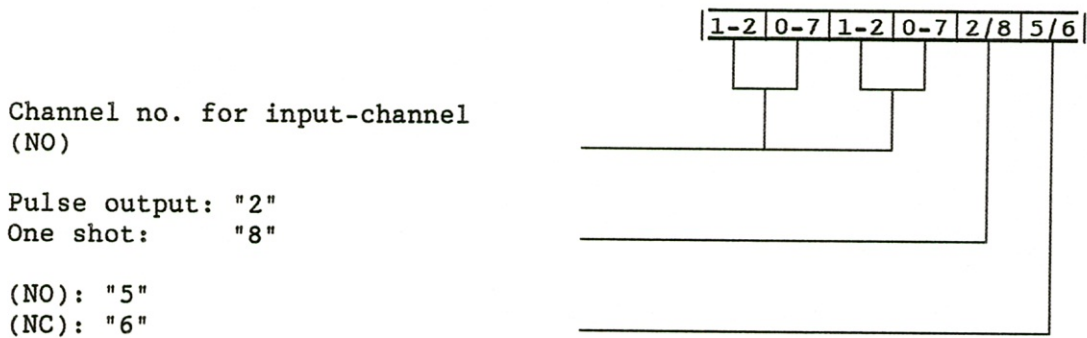


Used with pulse output/one shot:

The additional input-channel must be an I/O-channel (10-27).

NB: The channel number of the input-channel is inserted in Code9 of the output-channel (Reg. 9) both in digit 1 and 2 and in digit 3 and 4.

The tolerated delay of the FB-signal is inserted in the IOPreset of the input-channel (Reg. 8). The duration of the pulse (at one shot) is inserted in IOTimer of the input-channel (reg. 1). Output-function and FB-function is inserted in Code9 of the output-channel (Reg. 9).



3.3. Double FB-signal with adjustable delay.

When using two FB-signals it is necessary to use two additional input-channels, channel A and channel B.

A normally open contact is connected to channel A and a normally closed contact to channel B.

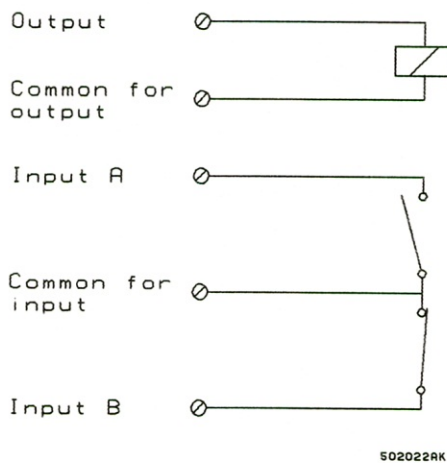
Function:

When output is OFF input A must be reset (contact open) and input B must be set (contact closed).

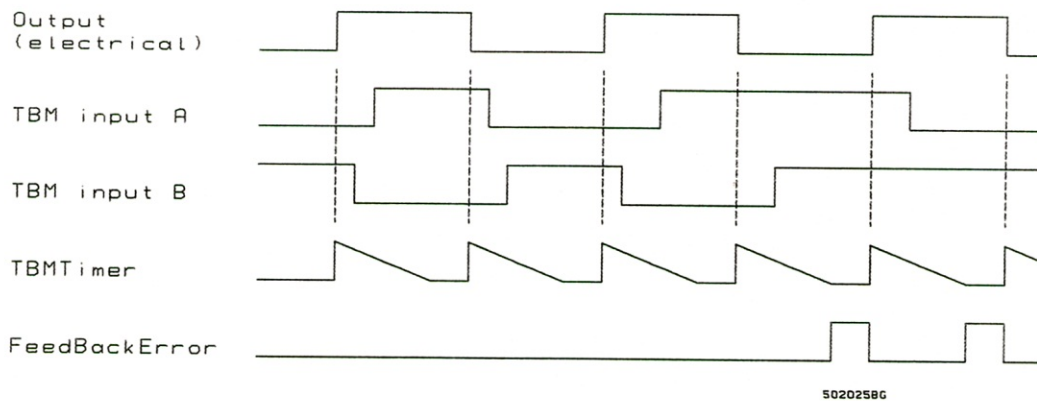
The largest tolerated delay of the FB-signal ($t_{d\ max}$) is inserted in the IOPreset of the output-channel (Reg. 8).

When output shifts both input A and input B must shift within the time $t_{d\ max}$. If this doesn't happen the FeedBackError flag in the flag register of the output-channel (Reg. 0) is set.

Connection to terminal strip:



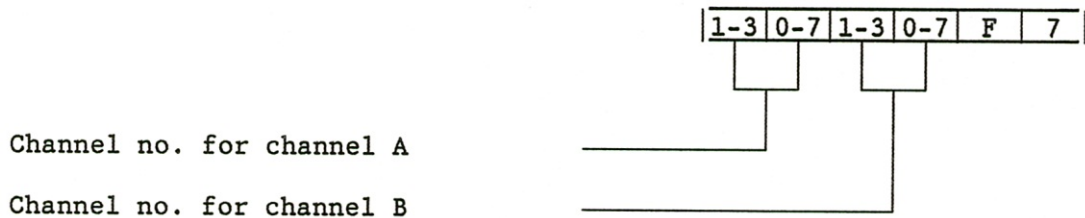
Time schedule:



3.3.1. Double FB-signal (adjustable delay) used with output.

The additional input-channels can be either input-channels (30-37) or I/O-channels (10-27) set to input.

Code9 of the output-channel is set as follows:



Used with pulse output/one shot.

The additional channels must be:

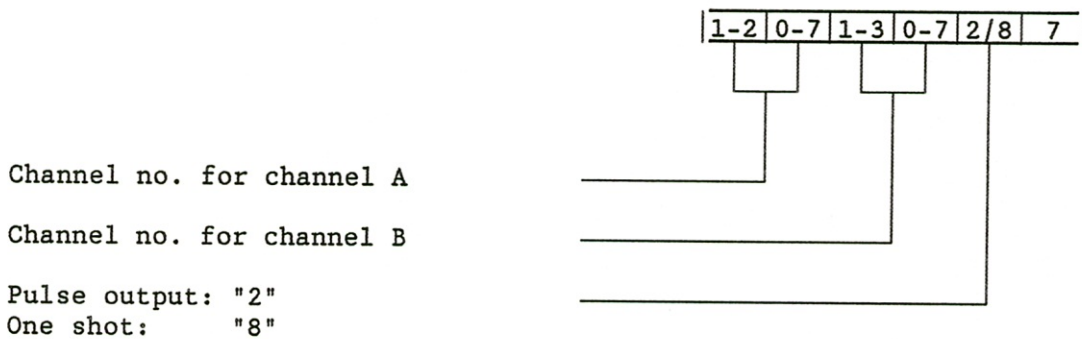
- Channel A: 1 I/O-channel (10-27) set to input.
- Channel B: 1 I/O-channel (10-27) set to input or
1 input-channel (30-37).

The FeedBackError delay is inserted in IOPreSet of the output-channel (Reg. 8).

The pulse length (at pulse output) is inserted in the timer-preset register of channel A (Reg.8).

The duration of the pulse (at one shot) is inserted in IOTimer of channel A (Reg. 1).

Code9 of the output-channel is set as follows:



4. Automatic functions.

The automatic functions are switched on and off by means of the Control flag in FlagReg of the output-channel (Reg. 0).

2 additional input-channels, channel A and B, are used to handle the external signals.

4.1. Pulse output controlled by external signals (and timer).

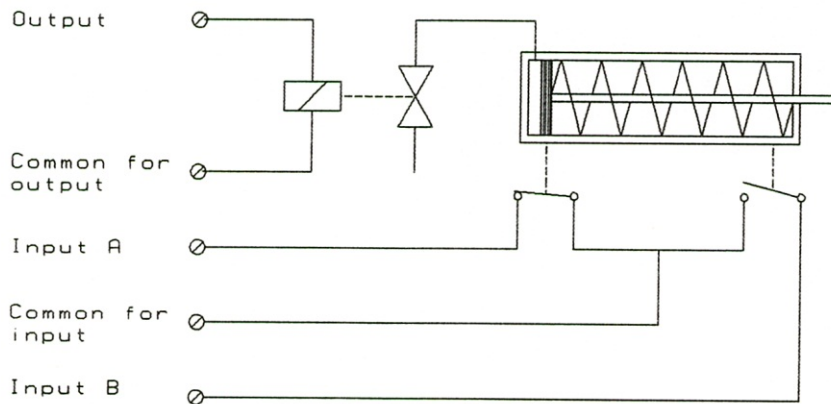
The following functions are illustrated using as an example an air cylinder fitted with two microswitches.

Output controls a magnet valve. When the magnet valve is open the pressure in the cylinder will move the ram.

Output OFF: Contact A closed, contact B open.

Output ON: Contact A open, contact B closed.

Connection to terminal strip:



502022AL

4.1.1. Pulse output controlled by external signals.

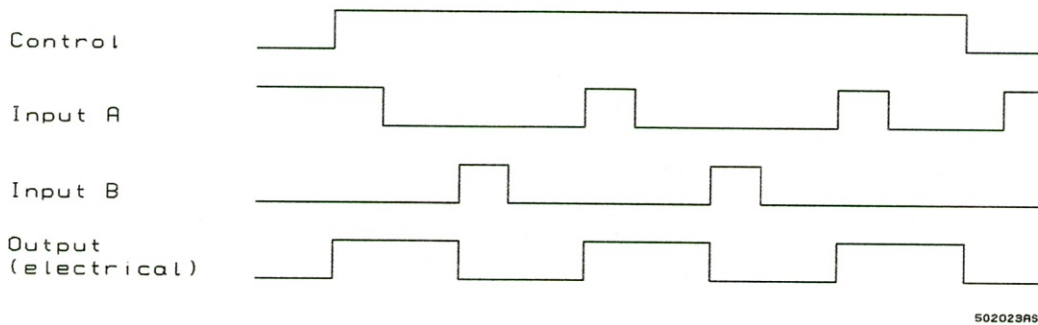
Function:

The ram will pendulate as long as the Control flag is set.

With no pressure on the cylinder contact A is closed and contact B is open.

When the Control flag is set, output goes ON (because input A is set) and the ram will start to move. Shortly after, input A will be reset. When the ram reaches its extreme position, input B will be set and output goes OFF. The pressure will now fall, the ram will move backwards and input B will be reset. When the ram reaches its start position, input A will be set, output goes ON and so on - until the Control flag is reset which will cause output to go OFF, the pressure will fall and the ram will return to its start position with input B reset and input A set.

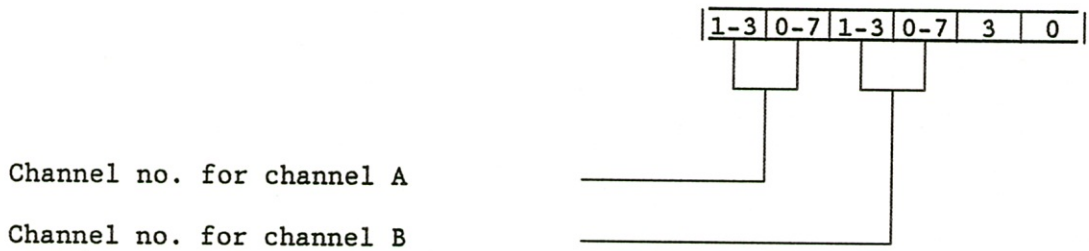
Time schedule:



Setting of the module:

The additional input-channels can be any channel (10-37). When using a I/O-channel (10-27) this must be set to input.

Output-function, FB-function and the channel numbers of channel A and B are inserted in Code9 of the output-channel (Reg. 9) as follows:



4.1.2. Pulse output controlled by external signals. Adjustable minimum time controlled by timer.

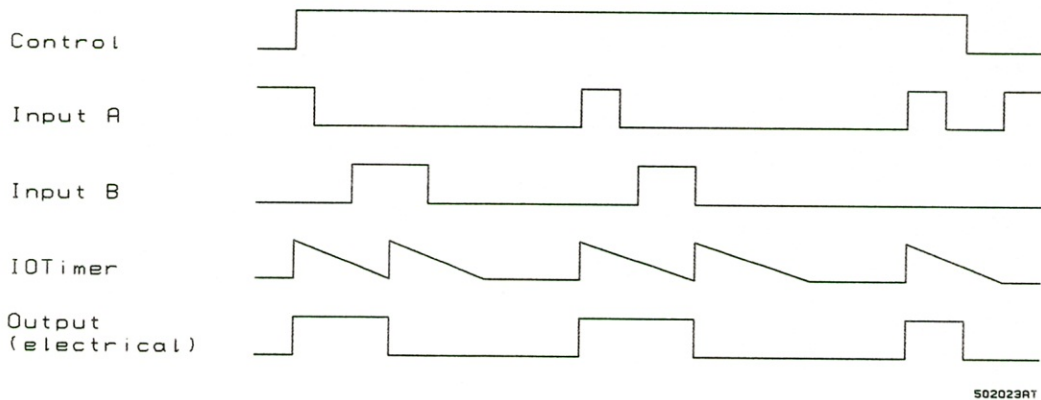
Function:

As long as the Control flag is set the ram will pendulate and rest in the extreme positions until the timer reaches 0.

The required minimum time between shifts on output is inserted in tenth of a second in IOPreset of the output channel (Reg. 8).

When the Control flag is set, output goes ON, IOTimer is preset (because input A is set and the IOTimer = 0) and the ram will start to move. Shortly after, input A will be reset. When the ram reaches its extreme position, input B will be set. If the IOTimer = 0 output goes OFF. If not, output will not go OFF until the IOTimer = 0. When output goes OFF, IOTimer is preset, the pressure will fall, the ram will move backwards and input B will be reset. When the ram reaches its start position, input A will be set and output will go ON as soon as the IOTimer = 0 and so on - until the Control flag is reset which will cause output to go OFF, the pressure will fall and the ram will return to its start position with input B reset and input A set.

Time schedule:



Setting of the module:

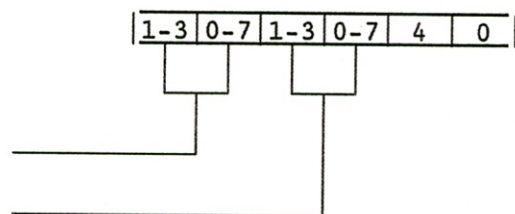
Channel A and B may be either I/O-channels (10-27) set to input or input-channels (30-37).

Output-function, FB-function and the channel numbers of channel A and B are inserted in Code9 of the output-channel (Reg. 9).

Code9 for output-channel (Reg. 9)

Channel no. for channel A

Channel no. for channel B



4.1.3. Pulse output controlled by external signals, adjustable time.

Function:

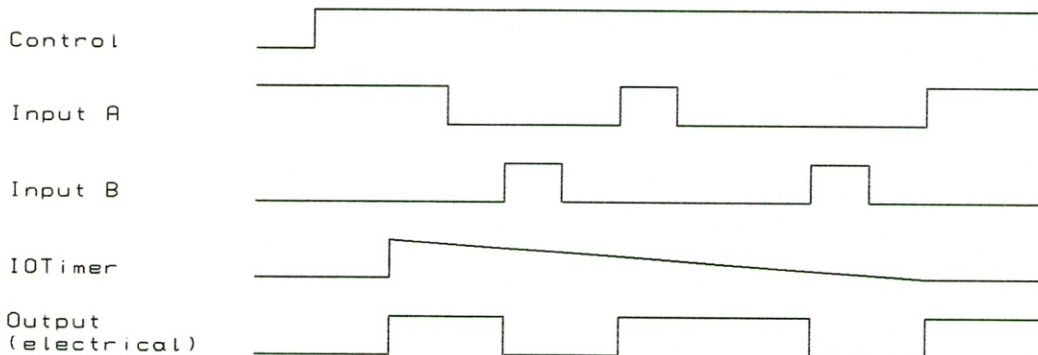
Output is controlled as explained in paragraph 4.1.1.

The desired time of action is inserted (via P-net) in tenth of a second in IOTimer of channel A (Reg. 1).

As long as the IOTimer hasn't reached 0, output goes ON when input A is set and OFF when input B is set.

IOTimer is not pre-set automatically but must be pre-set via P-net.

Time schedule:



502023AU

Setting of the module:

Two additional input-channels are used.

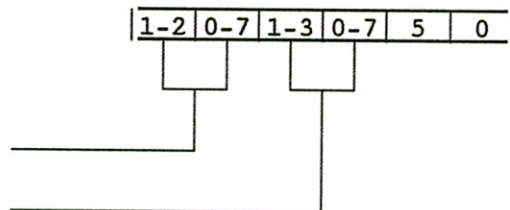
Channel B must be an I/O-channel (10-27) set to input and channel B can be either an I/O-channel (10-27) set to input or an input-channel (30-37).

Output-function, FB-function and the channel numbers for channel A and B are inserted in Code9 of the output-channel (Reg. 9).

Code9 for
output-channel (Reg. 9)

Channel no. for channel A

Channel no. for channel B



4.1.4. Pulse output controlled by external signals. Adjustable number of strokes.

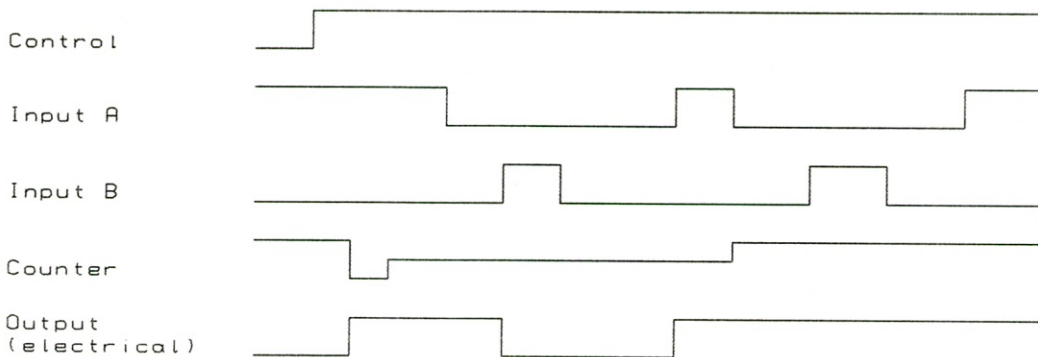
Function:

Output is controlled as explained in paragraph 4.1.1.

The desired number of strokes is inserted (via P-net) in Counter of channel A (Reg. 1). The inserted number must be negative as the counter counts up!

As long as the Counter hasn't reached 0, output goes ON when input A is set and OFF when input B is set. When Counter reaches 0, output will not go ON when input B is set.

Time schedule:



502023AV

Setting of the module:

Two additional input-channels are used.

Channel A must be an input-channel (30-37) and Channel B can be either an I/O-channel (10-27) set to input or an input-channel (30-37).

Output-function, FB-function and the channel numbers for channel A and B are inserted in Code9 of the output-channel (Reg. 9).



4.1.5. Pulse output controlled by external signals. Minimum period.

Function:

Output is controlled as explained in paragraph 4.1.1.

The ram pendulates for a period equal to the value inserted in the IOTimer for channel A (Reg. 1) and rests in the extreme positions for a period equal to the value inserted in IOPreset for the output-channel (Reg. 8).

IOTimer values must be inserted via P-net in tenth of a second.

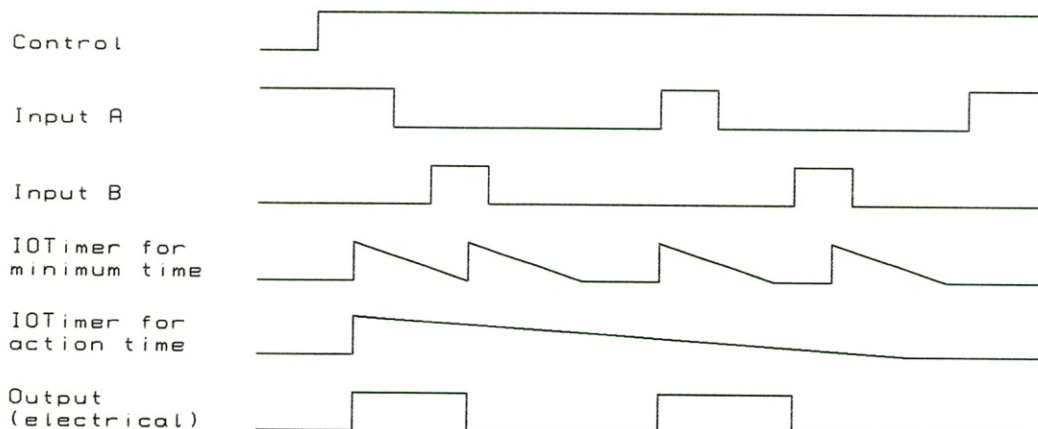
IOTimer for minimum time is automatically pre-set when output shifts.

IOTimer for action time must be pre-set via P-net.

As long as the IOTimer for action time hasn't reached 0, output goes ON when input A is set and the IOTimer for minimum time has reached 0. (At the same time IOTimer for minimum time is pre-set). Output goes OFF when input B is set and IOTimer for minimum time has reached 0. (At the same time IOTimer for minimum time is preset).

If output is ON when timer for action time reaches 0, output will stay ON. If output is OFF it stays OFF.

Time schedule:



50202BRX

Setting of the module:

Two additional channels are used.

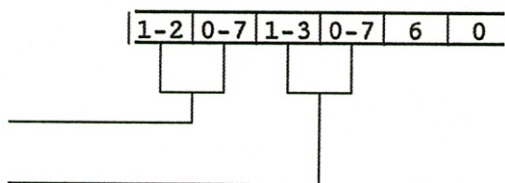
Channel A: 1 I/O-channel (10-27) set to input.

Channel B: 1 I/O-channel (10-27) set to input or
1 input-channel (30-37).

Output-function, FB-function and the channel numbers of channel A and B are inserted in Code9 of the output-channel.

Channel no. for channel A

Channel no. for channel B



4.1.6. Pulse output controlled by external signals. Adjustable minimum time and adjustable action time.

Function:

The ram pendulates until the desired number of strokes has been reached and it rests in the extreme positions for a period equal to the value inserted in IOPreset for the output-channel (Reg. 8).

The timer value must be inserted via P-net in tenth of a second.

The desired number of strokes is inserted in Counter for channel A (Reg. 1). (Insert negative value!).

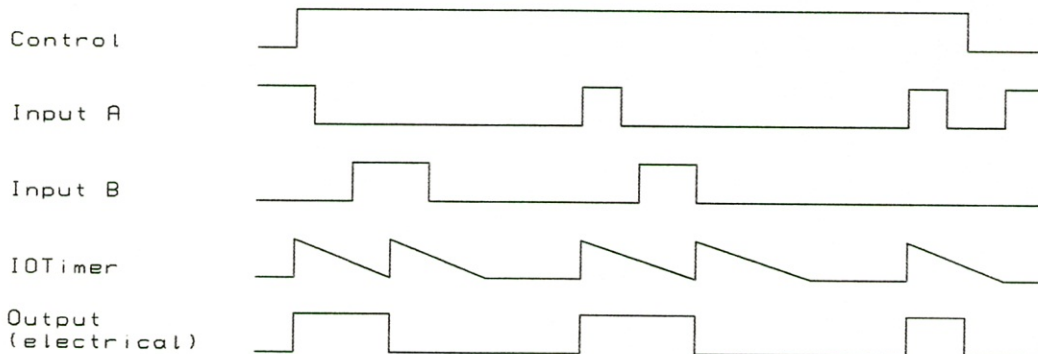
As long as Counter hasn't reached 0, output goes ON when input A is set and IOTimer has reached 0 and OFF when input B is set and the timer has reached 0.

When Counter reaches 0 output will not be reset - not even if input B is set and IOTimer has reached 0.

IOTimer for minimum time is automatically pre-set when output shifts.

Counter is pre-set via P-net.

Time schedule:



502029RT

Setting of the module:

Two additional input-channels are used.

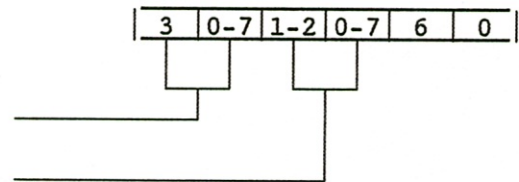
Channel A: 1 input-channel (30-37)

Channel B: 1 I/O-channel (10-27) set to input.

Output-function, FB-function and the channel numbers of channel A and B are inserted in Code9 of the output-channel.

Channel no. for channel A

Channel no. for channel B



4.2. Time batching with FB-signal and silo empty signal.

This function is designed for batching purposes where time batching takes place from a silo via a belt line.

Two additional input-channels are used.

One input supervises the belt line motor, the other supervises the level in the silo.

If the motor falls out, the batching timer will go stand-by and an FB-error will be reported. When the motor starts again the batching timer continues until the batching time is over.

If the silo runs out of material, the motor will stop, an FB-error will be reported and the batching timer will go stand-by until new material is loaded into the silo. Then the motor starts and the batching goes on until the batching time is over.

Function:

Two normally open contacts are mounted, one on the motor relay and the other near the bottom of the silo.

The batching time is inserted in IOTimer of the output- channel (Reg. 1).

When IOTimer is preset via P-net and input B is set (silo not empty), output goes ON (motor starts) and input A is set.

If input A is reset (motor stops due to over load etc), IOTimer will stop.

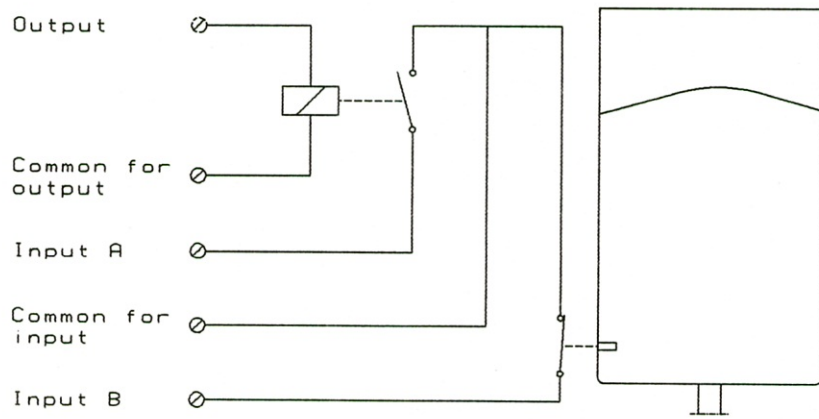
If input B is reset (silo empty), output goes OFF, input A will be reset and IOTimer will stop.

When input B is set again (new material in silo), output goes ON, input A is set and IOTimer continues.

When IOTimer reaches 0 (batching time over), output goes OFF.

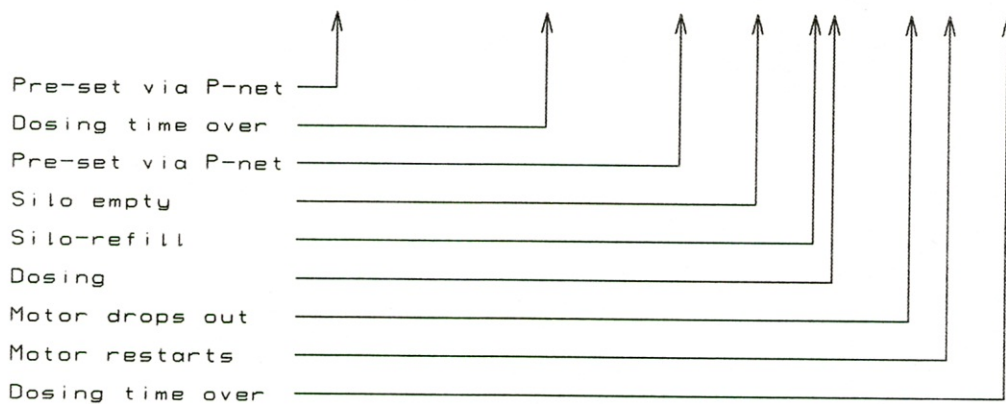
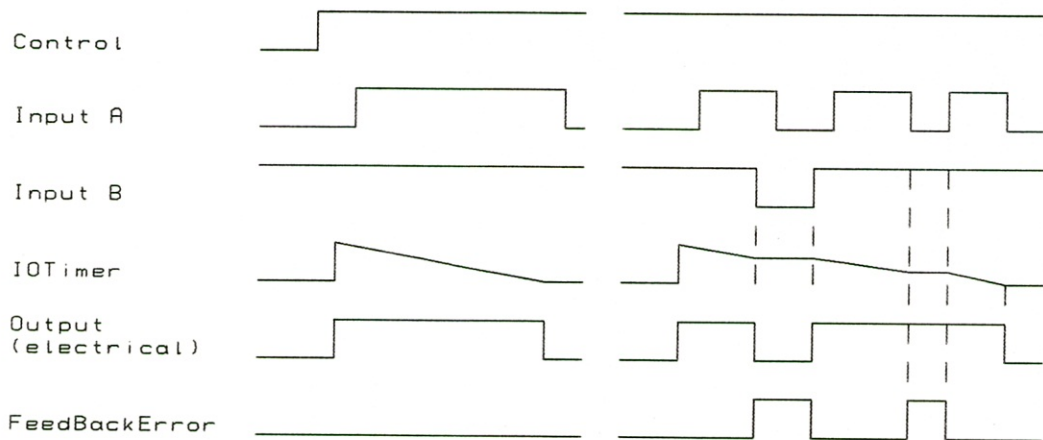
A new batch is started by presetting IOTimer via P-net.

Connection to terminal strip:



S02022RH

Time schedule:



S02023AZ

Setting of the module:

Two additional input-channels are used.

Channel A: Free choice (10-37)
 Channel B:

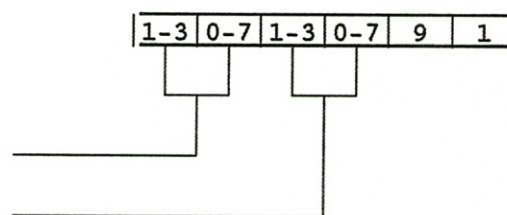
(When using I/O-channels these must be set to input).

Output-function, FB-function and the channel numbers of channel A and B are inserted in Code9 of the output-channel.

Code9 for
 output-channel (Reg. 9)

Channel no. for channel A

Channel no. for channel B



4.3. Level control with FB-signal.

This function is designed to keep the level in a silo between two fixed points.

Two additional input-channels are used.

Output controls a valve through which the silo is filled.

The inputs supervises the level in the silo.

If the level goes below minimum, output goes ON, the valve opens and the silo is filled until the level reaches maximum. Then output goes OFF, and the valve will close.

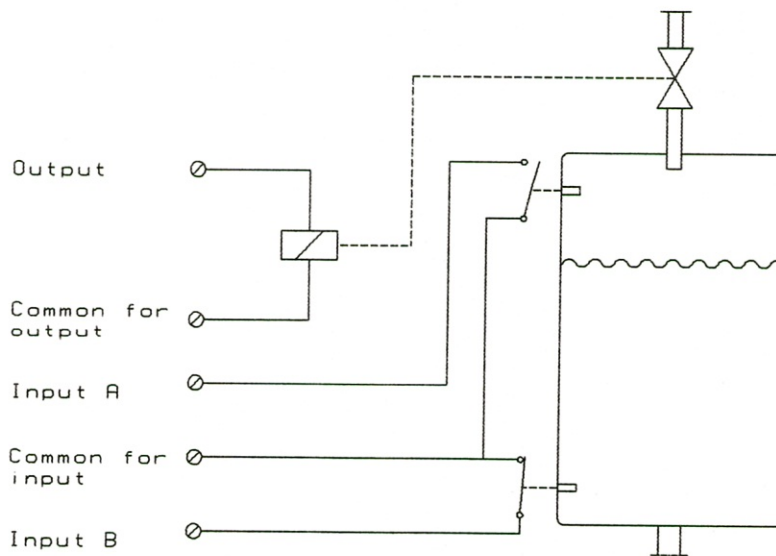
Function:

Two detectors are placed in the silo. Input B is connected to the upper detector and Input A to the lower one.

If input A is reset (silo empty), output goes ON.

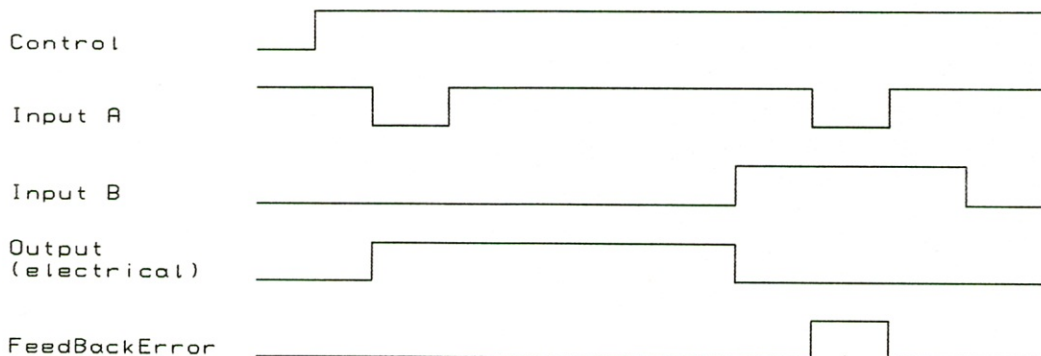
When input B is set (silo full), output goes OFF (refill over).

Connection to terminal strip:



502022AN

Time schedule:



502023BR

Setting of the module:

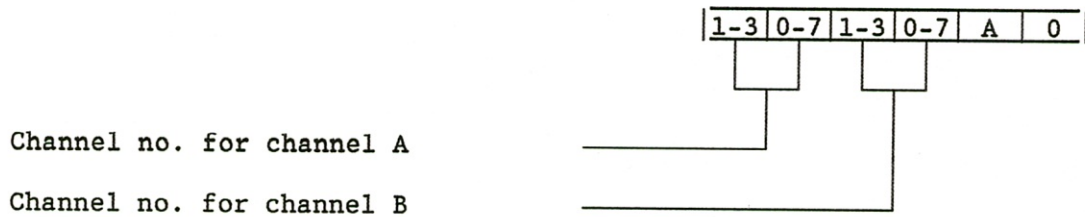
Two additional input-channels are used.

Channel A: Free choice (10-37)

Channel B: Free choice (10-37)

When using I/O-channels these must be set to input.

Output-function, FB-function and the channel numbers of channel A and B are inserted in Code9 of the output-channel.



5. Service channel (channel 0).

The service channel contains information for the P-net about the type of device and the programme version. It supervises the μ -processor and collects error codes from the other channels and furthermore it contains a supervision facility called watch-dog.

The watch-dog will automatically cut off all outputs in case of external errors e.g. disconnection of communication line or power supply for the computer or any error which will cause that the module is not called from the P-net.

The operator himself decides the maximum of time allowed between two calls to the module via P-net. If this time is exceeded, the watch-dog will cut off all outputs and an error code will appear in the display and in the error codes (Reg. F) of all channels.

5.1. Registers on service channel.

Reg.no	Contents	Write	Storage medium	Number of bytes	Read-out
0					
1	DeviceType		P	2	Decimal
2	ProgVers		P	2	Decimal
3	Error3		R	1	Hexadec.
4					
5					
6					
7	WDTimer	X	R	2	Decimal
8	WDPreset	(X)	E	2	Decimal
9	Code9	(X)	E	4	Hexadec.
A					
B					
C					
D					
E					
F	CHError		R	1	Hexadec.

Reg. 1: DeviceType.

This register contains a device identification number used by the P-net. The number is 1331.

Reg. 2: PrgVers.

This register contains the programme version number which is 8601.

The contents of register 1 and 2 can not be changed.

Reg. 3: Error3

All errors are graded after how serious they are. This register contains the error code of the most serious error present since last error code read out. (also see "Reg. F").

Reg. 7: WDTimer.

WDTimer is automatically preset with the value from WDPreset each time the module is called from the P-net. If the WDTimer reaches 0 before it is preset again, the watch-dog flag will be reset and all outputs will be cut off.

Note: When switching on the system WDTimer must be preset via P-net. This will set the watch-dog flag and enable the outputs to go ON.

Reg. 8: WDPreset.

The maximum time allowed between two calls for the module is inserted in this register.

Reg. 9: Code9.

Digit no.	1	2	3	4	5	6
	0	0	0	0	0	0/1

The watch-dog facility may be switched on and off.

The register contains 6 digits. (Digit 1 to 5 are not used).

Digit 6:

- "0": Watch-dog ON (watch-dog flag controlled by timer 7).
- "1": Watch-dog OFF (watch-dog flag always set).

Reg. F: CHError

If an error appears CHError will contain an error code indicating the type of error. If the error disappears by itself, the error code will also disappear. (Also see "Reg. 3").

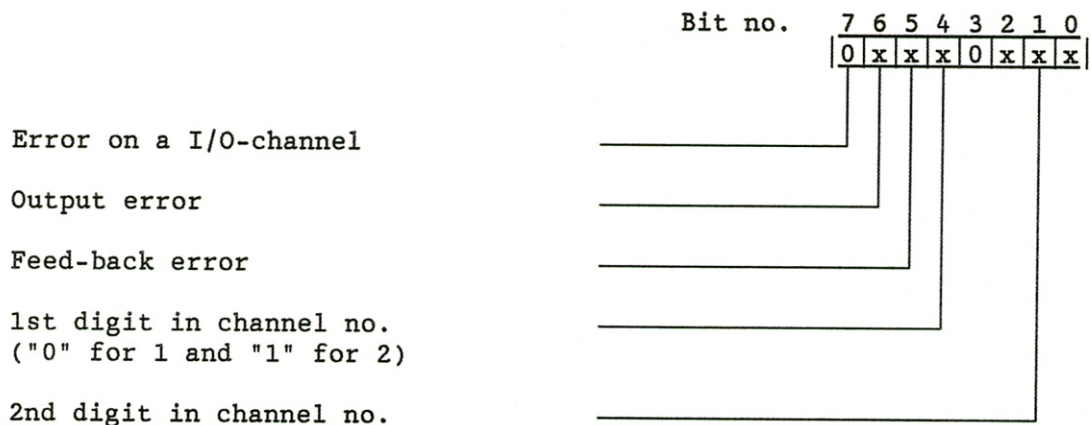
CHError is formed by calculating the hexadecimal value of the 8 bits in the register.

Error codes between 20 and 77 concerns the individual channels.

Error codes between 80 and 93 concerns the whole module.

Bit no. 7 6 5 _
 | 0 | x | x | _

If the most significant bit (bit 7) is "0", it is an error code between 20 and 77.



If bit 6 is set there is an output error.

If bit 5 is set there is an feed-back error.

The remaining 5 bits states the channel no. of the channel on which there is an error.

If further information about an output error is required it is necessary to compare the contents of FlagReg and CHError on the channel in question. (See the table in paragraph 2.2.2. "Err1Flag, Err2Flag").

Bit no. 7 6 5
 | 1 | x | x | | |

If the most significant bit (bit 7) is "1" it is an error code between 80 and 93.

These error codes converted to hexadecimal representation has the following meaning:

<u>Error code</u>	<u>Meaning</u>
80	Over load on voltage output
84	Outputs cut off by watch-dog (hardware-error)
85	Outputs cut off by watch-dog (time exceeded)
86	Error in programme execution (internal error)
90	Error in programme execution (-processor in lack of time)
91	EEPROM default
92	Data store default
93	Programme store default

Note: While inserting in IOPreset, Code9 and Scale, error code 91 is reported.

6. Voltage output.

The PD 1331 module is provided with a voltage output giving 24 V DC, max. 150 mA.

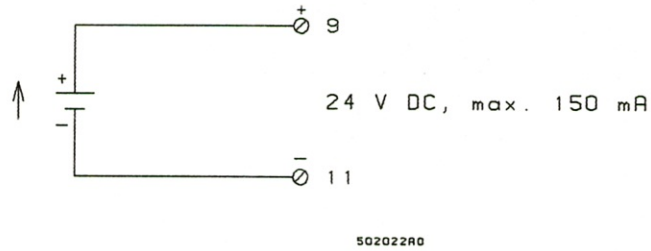


Fig. 3.a.: Voltage output, schematic.

The voltage output may be used for power supply for external DC-equipment.

The voltage output is protected against over load by means of a zener diode and a current limiting resistor.

At over load Code9 on the service channel will contain error code 80.

After an over load situation the load must be disconnected for some seconds to allow the circuit to cool off.

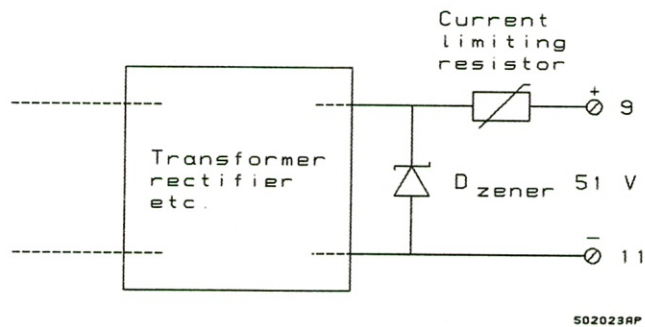
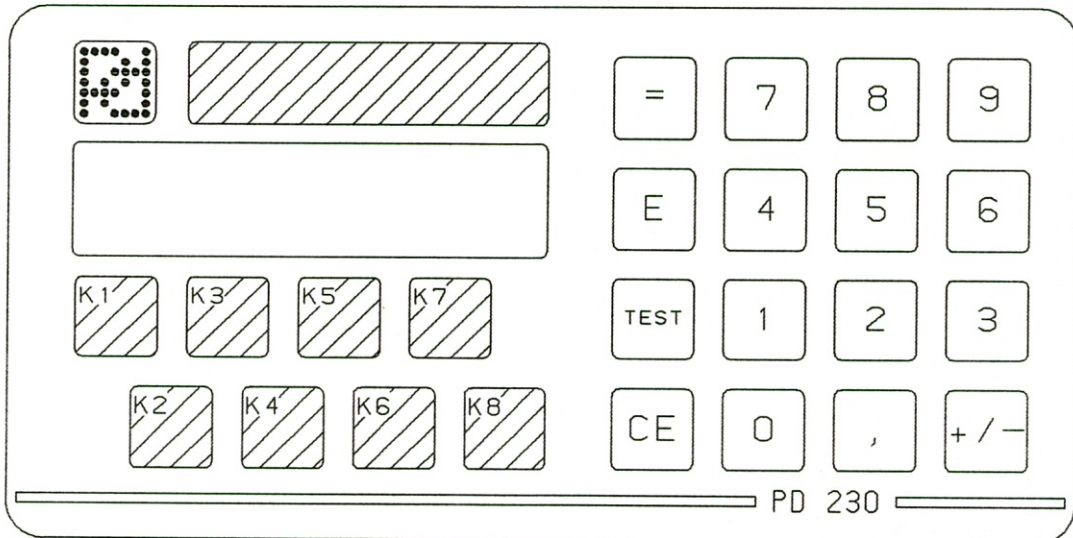


Fig. 3.b.: Voltage output, electrically.

7. Display-unit PD 230.

The display-unit PD 230 can be connected directly to the PD 1331 module. Read out of measuring results and error codes as well as pre-set of counters is performed from the display-unit.



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7.1. Operation of PD 230.

Read out of measuring results.

The contents of the 8 counters of the input-channels may be displayed on the PD 230. Also the contents of the frequency/time per cycle/RPM register can be displayed. The unit for the read out and the number of digits after the decimal point is selected by means of Code9 of channel 30.

The channel to read out is selected by pressing one of the 8 buttons under the display window. An arrow in the display indicates which channel the read out belongs to. The display is updated approx. once per second.

Preset of counters.

The contents of the 8 counters of the input-channels may be altered from the display-unit.

To pre-set a counter, first read out the old value as explained earlier. Then key in the pre-set value by means of the numeric keys and complete the session by pressing the "=" key. This procedure will insert the new value in the counter and the display-unit will return to its normal function.

Read out of error codes.

When the testsystem finds an error the operator will be informed by an "A" lit in the first digit of the display. When pressing the TEST-key the display will show an error code of two digits giving details about the error (see paragraph 5.1. "CHError"). The alarm will not be cleared - even if the error disappears again. The error code on the display is only updated when the TEST-key is pressed.

If more than one error appears at the time, only the code with the highest number will be preserved.

7.2. Connecting the PD 230.

The PD 230 is connected to the PD 1331 module using a two-wire cable. The PD 230 is power supplied through this cable and also the exchange of data between PD 230 and PD 1331 takes place here. The length of the cable should not exceed 100 meters and the cross-sectional area should be at least 0.75 mm².

The cable must connect the two terminals on the back side of the display-unit with the terminals no. 1 and 3 on the terminal board PD 1081/1091 on which the module is placed.

Note: The display-unit terminal marked with "+" must be connected to terminal strip no. 1.

7.3. Mounting the PD 230.

The Display-unit is designed for mounting e.g. in a panel (see assembly drawing below).

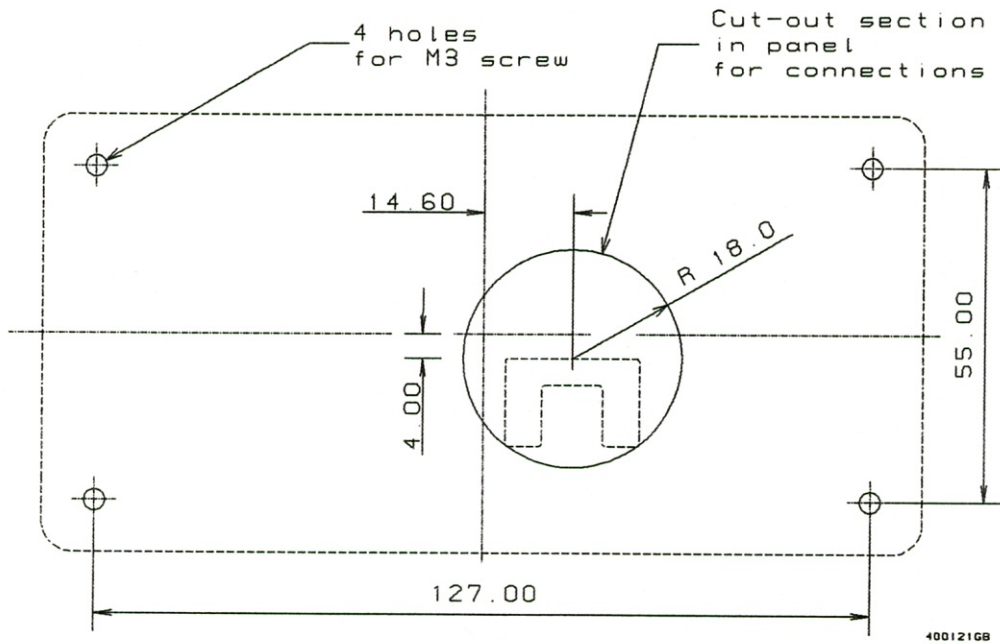


Fig. 7.3.a.: Cut out in panel for PD 230.

The dimensions of the display-unit is H x L x B = 8 x 144 x 72 mm.

The unit is water proof and resists temperatures between -10 and +50 C.

8. Mechanical structure of the PD 1331.

The PD 1331 module is built into a aluminum box. The dimensions of the box is B x H x D = 138.6 x 120 x 42 mm.

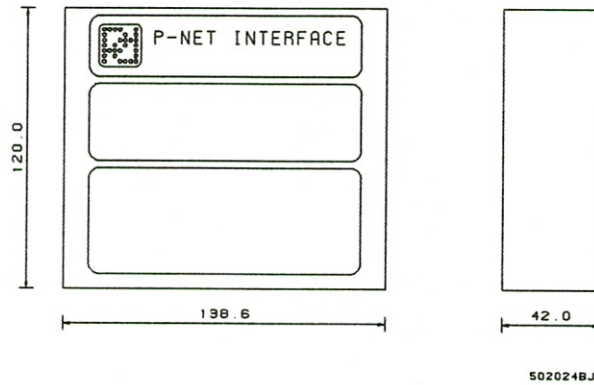


Fig. 8.a.: Aluminum box for PD 1331.

The module is designed for mounting on a terminal board PD 1081 (see fig. 8.b.) or PD 1091 (see fig. 8.c.) where the terminal strip and the "Programme enable"-switch are placed. The PD 1081 is a standard terminal board identical for all modules in Proce-Data's module series 1000 its size being 142 x 150 mm. The PD 1091 terminal board is specially designed for the PD 1331 module as it has a number of extra terminal strips.

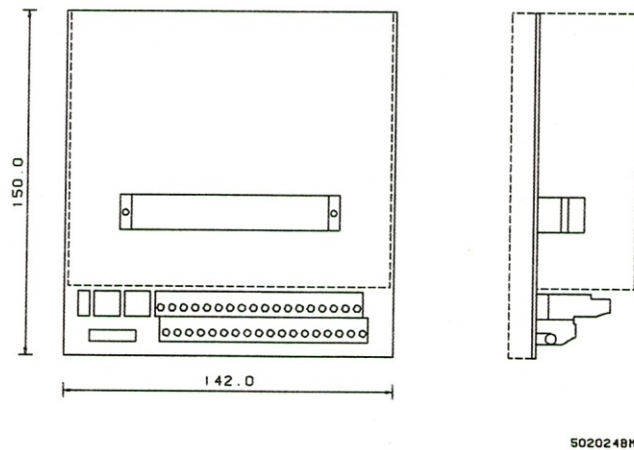


Fig. 8.b.: Terminal board PD 1081

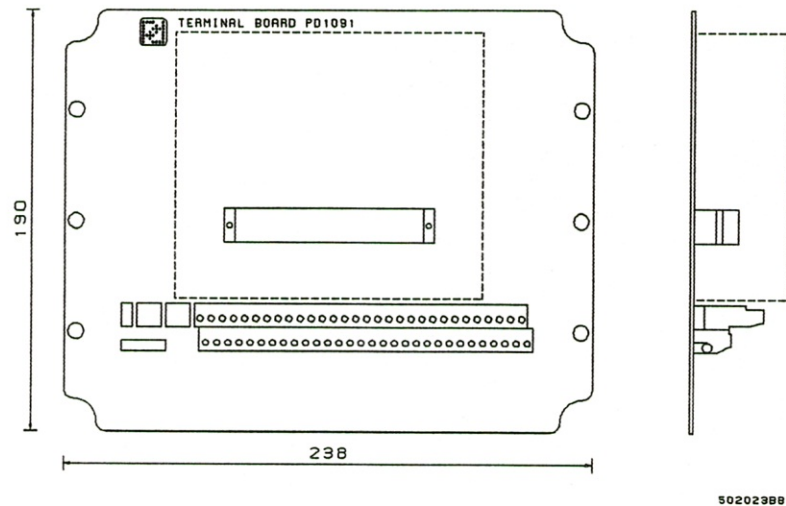


Fig. 8.c.: Terminal board PD 1091.

Modules are connected to the terminal board with a plug allowing modules to be changed without disconnecting the supply lines.


Two rotary switches are placed on the terminal board next to the terminal strip. They are used when defining the module's P-net address which is a number between 01 and 7E.

The fact that the P-net address is selected from the terminal board means that modules can be replaced and changed without altering the setting of the rotary switches.

9. Specifications.

	min.	typic	max.	unit
Supply voltage	20.4	24	27.6	V AC
Power consumption (excl. external consumption)	48	67	87	mW
Output:				
Output current	1	-	350	mA AC
Voltage drop over output				
at 350 mA	-	2.5	2.8	V AC
at 100 mA	-	2.8	3.6	
Leakvoltage with output OFF	-	-	1	mA AC
Input:				
Input voltage at "1"	0	-	6	V DC
Input voltage at "0"	18	-	30	V DC
Input current when input voltage = 0	-	-	10	mA
Ambient temperature	0	-	50	°C
Voltage output:				
Output voltage	23.5	24.0	25.6	V DC
Output current	-	-	150	mA DC

10. Connections.




P-NET INTERFACE

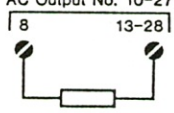
PD1331 DIGITAL I/O — AC

External Connections

P-Net

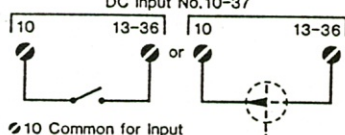


AC Output No. 10-27



8 Common for Output

DC Input No. 10-37



10 Common for Input

10 ↔ 11 Internal Connected

Voltage Output 24 V DC /max. 150 mA

On	P-Net No.		Display		I/O No. 10-17														Input No. 30-33				
	MSD	LSD	+	-	+	-	10	11	12	13	14	15	16	17	30	31	32	33					
	1	3	5	7	9	11	13	15	17	19	21	23	25	27	29	31	33	35					
Off																							

Programme Enable Power Input 24 V AC ± 15%, 50/60 Hz

Fuse 4 A	P-Net			I/O No. 20-27														Input No. 34-37			
	A	B	S	~	~	⊥	20	21	22	23	24	25	26	27	34	35	36	37			
	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36			

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