

# M2400 Analog Output

## Technical Description

**BECKHOFF**  

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**INDUSTRIE ELEKTRONIK**

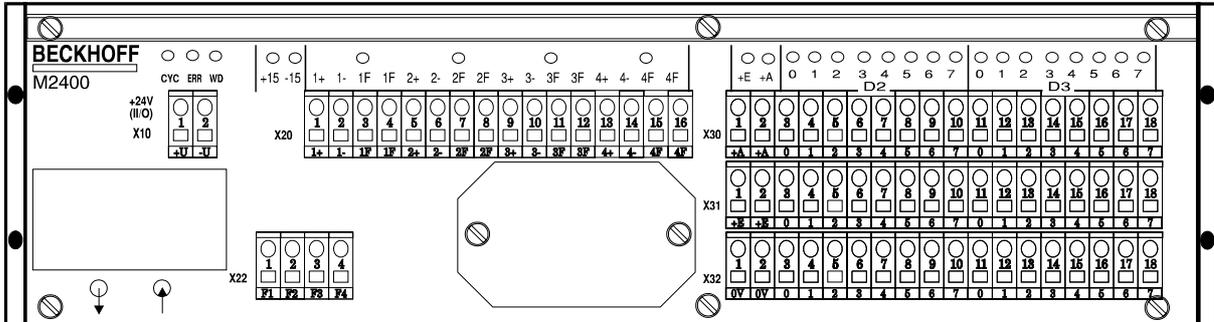
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## 1. Function Description Hardware



*M2400*

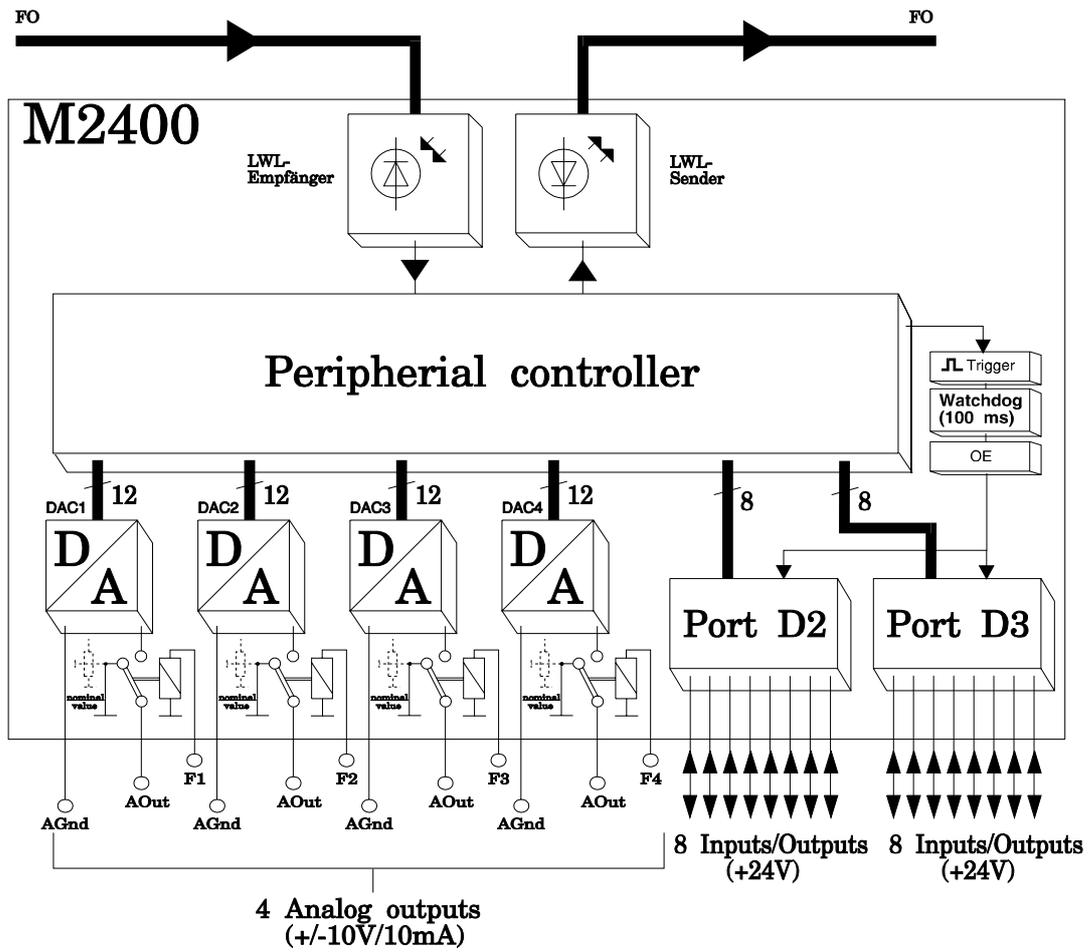
### About the Hardware

The parallel module M2400 is an input / output module used in the II/O system. There are 16 standard 24 V inputs / outputs, which achieve 2 ports of 8 bit each, and four analog output channels.

Each input / output has an LED, that indicates the current state. Furthermore there are three LED's installed used for diagnosis of the II/O fibre optical ring:

- LD1** The green 'CYCLE' LED is switched on by each start bit of a telegram and is switched off again by the stop bit.
- LD2** The red 'ERROR' LED is switched on after recognition of bad telegram (checksum, frame). After a sequence of three correct telegrams (checksum, frame) were processed it is switched off again.
- LD3** The green LED 'WATCHDOG' is switched on by a valid writing telegram with matching address. If no telegram with the properties defined above is recognised for the next 100 ms a special unit of the module switches off all outputs.

In case an error is detected, all outputs are reset.



Basic Circuit Diagram

## 2. Function Description Software

The four ports D0..D3 correspond to the data bytes in the FO transmission protocol.

### Analog Output

Through the analog channels 1 to 4 of the M2400 analog values of 12 bit resolution are transmitted in a voltage range of - 10V .. + 10V. The selection of a certain DAC is done by a logic "0" one of the most significant 4 bits of port D1.

The transmission of the 12 bit data word is done by the least significant four bits of port D1 and the eight bits of port D0.

SELECT	PORT D1		PORT D0	
	MSB	LSB	MSB	LSB
<i>DAC 1</i>	0 1 1 1	DDDD	DDDD	DDDD
<i>DAC 2</i>	1 0 1 1	DDDD	DDDD	DDDD
<i>DAC 3</i>	1 1 0 1	DDDD	DDDD	DDDD
<i>DAC 4</i>	1 1 1 0	DDDD	DDDD	DDDD
	4 bit select low-active	12 bit data		

OUTPUT	PORT D1		PORT D0	
	MSB	LSB	MSB	LSB
<i>+10V</i>	SSSS	0 0 0 0	0 0 0 0	0 0 0 0
<i>0V</i>	SSSS	1 0 0 0	0 0 0 0	0 0 0 0
<i>-10V</i>	SSSS	1 1 1 1	1 1 1 1	1 1 1 1
	4 bit select low-active	12 bit data		

### 3. Technical Data

<b>Analog Outputs</b>	max. 4
<b>Analog Specifications</b>	$U_{out} = \pm 10 \text{ V}$ , $I_{out} = 0 \text{ to } 20 \text{ mA}$ Resolution : 12 Bit
<b>Error, linearity</b>	+/- 1 LSB
<b>Rise time</b>	10 $\mu\text{s}$ von -10V ==> +10V
<b>Inputs / Outputs</b>	16, can be configured for each port; LED shows state of all inputs / outputs
<b>input switching voltages</b>	0 - 8V = LOW 15 - 24V = HIGH
<b>input delay</b>	0,7 ms RC network 6,8 ms input latch
<b>Input Specifications</b>	24 V DC, 10 mA, digital filter
<b>Output Specifications</b>	24 V DC, max. 500 mA, short circuit proof
<b>Output check</b>	watchdog system (100ms)
<b>Connections</b>	a) can be connected for digital I/O ; +,-,signal b) for analog output; signal,-,potential free contact, 1 permission input 24 VDC for each channel
<b>Data Connection</b>	fibre optic I/O system
<b>Transmission Rate</b>	2,5 MBaud, 25 $\mu\text{s}$ for 32 Bit
<b>Supply Voltage</b>	24 V DC ( $\pm 10\%$ )
<b>Input Current</b>	0,1 A (without load and input currents)
<b>Cartridge</b>	Aluminium profile cartridge, can be installed to cartridge carrier according to DIN EN 50022, 50035
<b>Size (B * W * D)</b>	270 * 76 * 68 mm
<b>Weight</b>	about 1100 g
<b>Working Temperature</b>	$\pm 0..+55 \text{ }^\circ\text{C}$
<b>Storage Temperature</b>	-20..+70 $^\circ\text{C}$

## 4. Installation

The M2400 is connected to the fibre optic ring, using fibre optic connectors (Toshiba). The maximum length of the FO cable, leading to the neighbouring boxes, should not exceed 600m for glass fibre or 45 meters for other fibres. These values are valid only if for bending the cable a radius of at least 30 mm is used. When using plastic FO, no special tools are needed for installation of the plugs.

Common actors and sensors are connected directly to the inputs / outputs (using "+,-,signal" ).

The M2400 is installed at the machine or simply by installing it to a cartridge carrier according to DIN EN 50022 or DIN EN 50035

### Configuration

The ports D0 and D1 are used for analog output. D2 and D3 can be configured as input or output according to the way they are used.

Each I/O port of the M2400 can be configured as input or as output. This does not dependent on the configuration of the other ports. There are DIP switches used for configuration.

The DIP switches are assigned as follows :

Switch 1	=>	Port D0	must always be 'ON'
Switch 2	=>	Port D1	must always be 'ON'
Switch 3	=>	Port D2	
Switch 4	=>	Port D3	

Depending on the state of the switches, the port is input or output :

'ON'	=>	port is output
'OFF'	=>	port is input

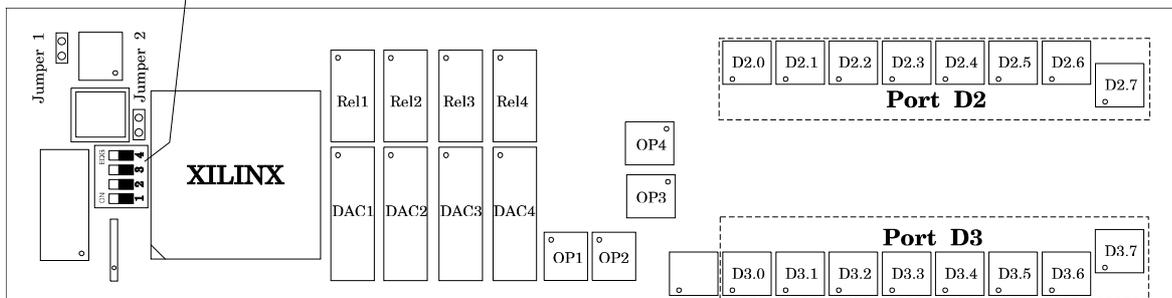
The DIP switch for ports D0 and D1 must be 'ON', to enable the analog channels to work as output.

**ATTENTION:**  
**Configuring a port as input ( switch "OFF") all of the eight output controller ICs of the port concerned have to be removed.**  
 If the ICs are not removed the port is not functional as input, the module is not damaged.

configuration switch S

- 1 : ON = Port D0 must always be 'ON'
- 2 : ON = Port D1 must always be 'ON'
- 3 : ON = Port D2 is Output    OFF = Port D2 is Input
- 4 : ON = Port D3 is Output    OFF = Port D3 is Input

Attention!    If a port is configured as an input  
 the output driver ICs have to be removed.

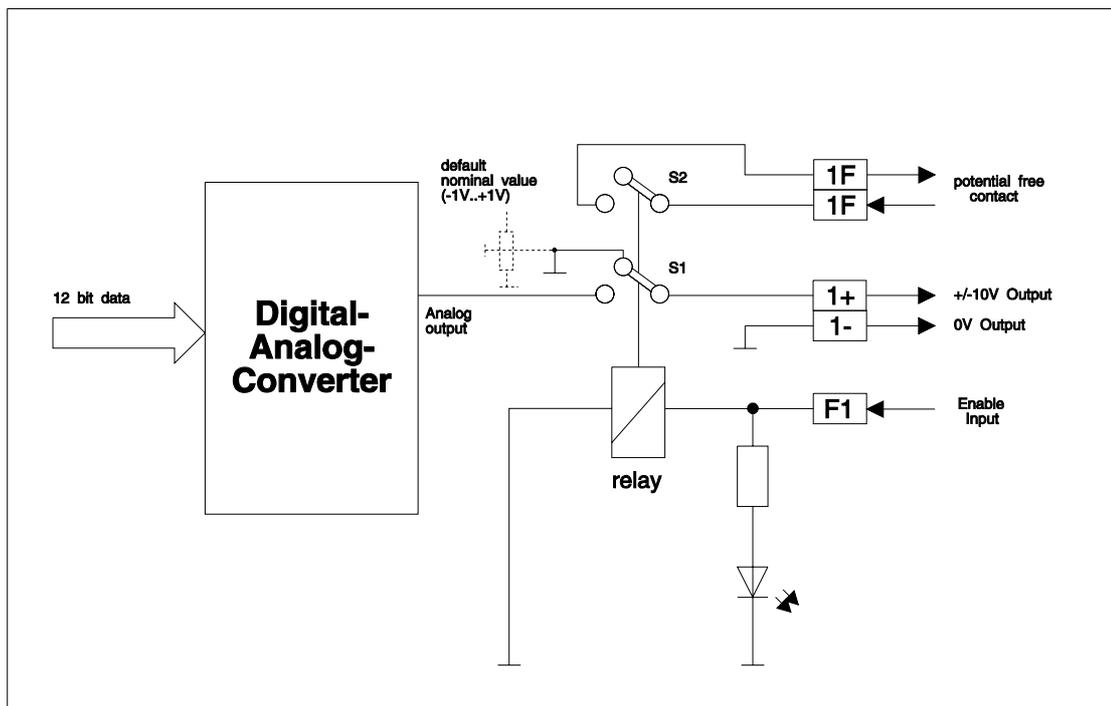


*View under the M2400 XILINX board*

The following module configuration is possible by setting jumpers 1 to 2 :

Jumper 1	<b><i>Watchdog on / off for Port D2 and D3</i></b>
	If this jumper is set the 'Watchdog' function is switched off. This means if an error is detected the outputs of Port D2 and D3 are not switched off.
Jumper 2	<b><i>Latch on / off</i></b>
	standard configuration is jumper 'set' inputs are latched in intervals of 6,8 ms otherwise inputs are scanned continuously

## Enabling the analog Outputs



In order to take the analog voltages from the connections, the appropriate relay of a certain analog channel has to be selected by applying 24 VDC to the relay input F1..F4 (connector X22).

As long as the enable input is not activated the output voltage is fixed to 0V or it can be adjusted to a default value in the range from -1V to +1V.

The selection can be done by one of the digital outputs too, if the output is connected to the relay input.

Each pair of contacts 1F, 2F, 3F and 4F on connector X20 provides a normally open switch for use on sens lines ( $I_{\max}=100\text{ mA}$ ,  $U_{\max}=24\text{V}$ ).

## Calibration

Each analog output of the M2400 can be calibrated separately.

The output that is to be calibrated has to be enabled by the corresponding relay.

For zero voltage calibration the 12 bit data word 800H has to be transmitted to the M2400. Zero voltage is calibrated by the potentiometer 'OFFSET'.

For calibration of gain the 12 bit data word FFFH or 000H is transmitted to the M2400. The analog output is calibrated by the potentiometer 'PITCH' to either -10V or +10V.

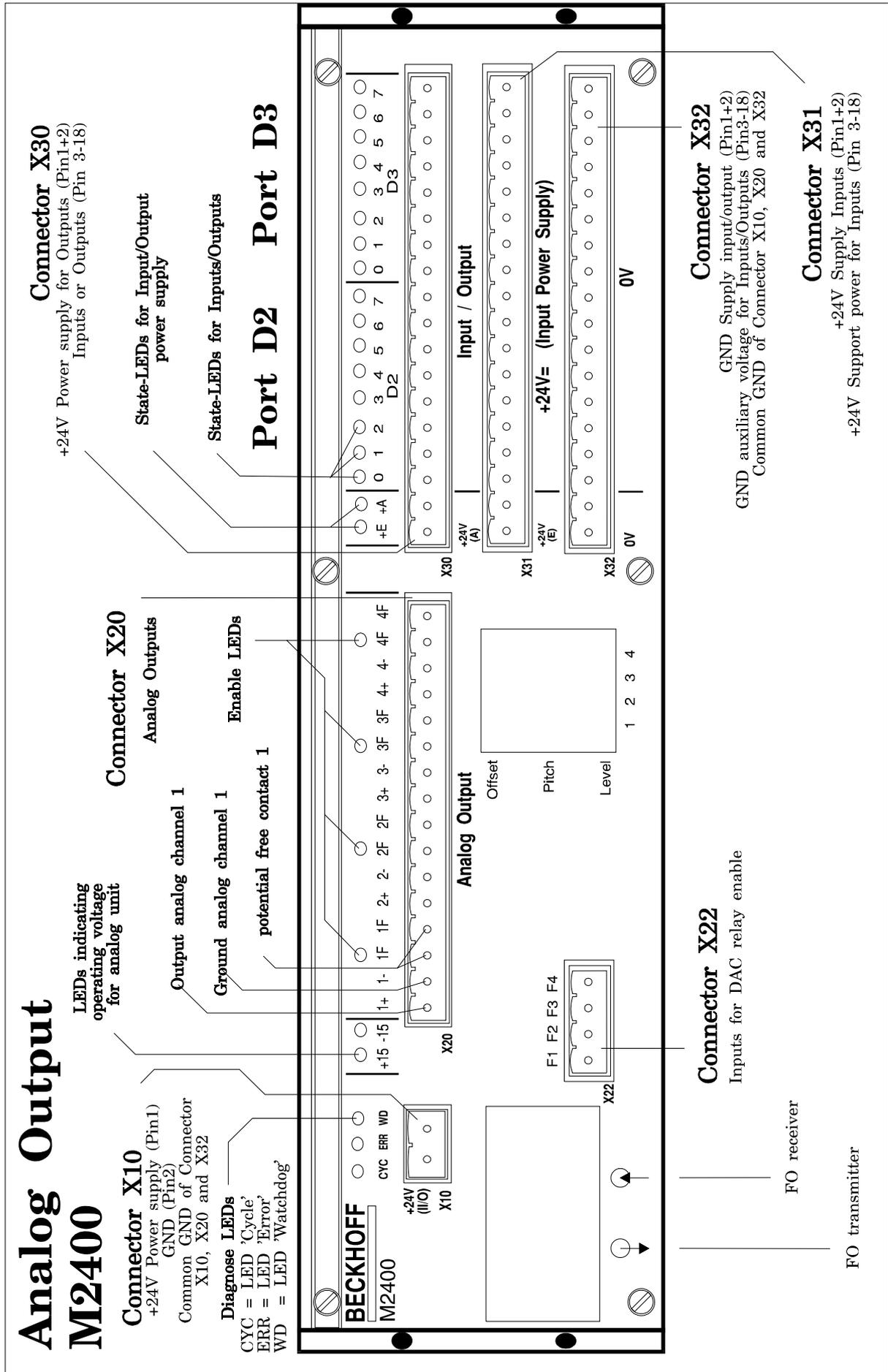
The potentiometer for adjustment and the default value can be found on the module after removing the small lid below X20.

The default output value is fixed to or by factory preset. Activation of level potentiometers is done by cutting a marked piece of copper trace on the pcb

## Power Supply

The following connectors are used for powers supply :

- (1) two pole plug connection for control logic (X10 Pin1+2)
- (2) two pole plug connection for outputs (X30 Pin1+2)  
(16 outputs)
- (3) two pole plug connection for inputs (X31 Pin1+2)  
(16 inputs)
- (4) two pole plug connection for ground (X32 Pin1+2)



## 5. Table of Connections

### Connector pin assignment with Signal Description

#### CONNECTOR X10

Connector	Pin	Signal	Description
X10	1	+U	+24V control power supply
X10	2	-U	GND ground

#### CONNECTOR X20

Connector	Pin	Signal	Description
X20	1	1+	Analog voltage output channel 1
X20	2	1-	GND ground for analog output channel 1
X20	3	1F	Potential free contact channel 1
X20	4	1F	Potential free contact channel 1
X20	5	2+	Analog voltage output channel 2
X20	6	2-	GND ground for analog output channel 2
X20	7	2F	Potential free contact channel 2
X20	8	2F	Potential free contact channel 2
X20	9	3+	Analog voltage output channel 3
X20	10	3-	GND ground for analog output channel 3
X20	11	3F	Potential free contact channel 3
X20	12	3F	Potential free contact channel 3
X20	13	4+	Analog voltage output channel 4
X20	14	4-	GND ground for analog output channel 4
X20	15	4F	Potential free contact channel 4
X20	16	4F	Potential free contact channel 4

#### CONNECTOR X22

Connector	Pin	Signal	Description
X22	1	F1	Input +24V Enable channel 1
X22	2	F2	Input +24V Enable channel 2
X22	3	F3	Input +24V Enable channel 3
X22	4	F4	Input +24V Enable channel 4

<b>CONNECTOR X30</b>
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Connector	Pin	Signal	Description
X30	1	+A	+24V supply for output
X30	2	+A	+24V supply for output
X30	3	D2.0	Bit 0 of Data byte 2 D2.0 is output, if DIL switch S1 = ON D2.0 is input, if DIL switch S1 = OFF
X30	4	D2.1	Bit 1 of Data byte 2 D2.1 is output, if DIL switch S1 = ON D2.1 is input, if DIL-switch S1 = OFF
X30	5	D2.2	Bit 2 of Data byte 2 D2.2 is output, if DIL switch S1 = ON D2.2 is input, if DIL switch S1 = OFF
X30	6	D2.3	Bit 3 of Data byte 2 D2.3 is output, if DIL-switch S1 = ON D2.3 is input, if DIL switch S1 = OFF
X30	7	D2.4	Bit 4 of Data byte 2 D2.4 is output, if DIL switch S1 = ON D2.4 is input, of DIL switch S1 = OFF
X30	8	D2.5	Bit 5 of Data byte 2 D2.5 is output, if DIL switch S1 = ON D2.5 is input, if DIL switch S1 = OFF
X30	9	D2.6	Bit 6 of Data byte 2 D2.6 is output, if DIL switch S1 = ON D2.6 is input, if DIL switch S1 = OFF
X30	10	D2.7	Bit 7 of Data byte 2 D2.7 is output, if DIL-switch S1 = ON D2.7 is input, if DIL switch S1 = OFF
X30	11	D3.0	Bit 0 of Data byte 3 D3.0 is output, if DIL switch S1 = ON D3.0 is input, of DIL switch S1 = OFF
X30	12	D3.1	Bit 1 of Data byte 3 D3.1 is output, if DIL switch S1 = ON D3.1 is input, if DIL switch S1 = OFF

continuation connector X30:

Connector	Pin	Signal	Description
X30	13	D3.2	Bit 2 of Data byte 3 D3.2 is output, if DIL switch S1 = ON D3.2 is input, if DIL switch S1 = OFF
X30	14	D3.3	Bit 3 of Data byte 3 D3.3 is output, if DIL switch S1 = ON D3.3 is input, if DIL switch S1 = OFF
X30	15	D3.4	Bit 4 of Data byte 3 D3.4 is output, if DIL switch S1 = ON D3.4 is input, if DIL switch S1 = OFF
X30	16	D3.5	Bit 5 of Data byte 3 D3.5 is output, if DIL switch S1 = ON D3.5 is input, if DIL switch S1 = OFF
X30	17	D3.6	Bit 6 of Data byte 3 D3.6 is output, if DIL switch S1 = ON D3.6 is input, if DIL switch S1 = OFF
X30	18	D3.7	Bit 7 of Data byte 3 D3.7 is output, if DIL switch S1 = ON D3.7 is input, if DIL switch S1 = OFF

**CONNECTOR X31**

Connector	Pin	Signal	Description
X31	1	+E	+24V supply inputs
X31	2	+E	+24V supply inputs
X31	3	+24V	+24V power supply for input 2.0
X31	4	+24V	+24V power supply for input 2.1
X31	5	+24V	+24V power supply for input 2.2
X31	6	+24V	+24V power supply for input 2.3
X31	7	+24V	+24V power supply for input 2.4
X31	8	+24V	+24V power supply for input 2.5
X31	9	+24V	+24V power supply for input 2.6
X31	10	+24V	+24V power supply for input 2.7
X31	11	+24V	+24V power supply for input 3.0
X31	12	+24V	+24V power supply for input 3.1
X31	13	+24V	+24V power supply for input 3.2
X31	14	+24V	+24V power supply for input 3.3
X31	15	+24V	+24V power supply for input 3.4
X31	16	+24V	+24V power supply for input 3.5
X31	17	+24V	+24V power supply for input 3.6
X31	18	+24V	+24V power supply for input 3.7

**CONNECTOR X32**

Connector	Pin	Signal	Description
X32	1	0V	GND Supply input/output
X32	2	0V	GND Supply input/output
X32	3	0V	GND Input/output D2.0
X32	4	0V	GND Input/output D2.1
X32	5	0V	GND Input/output D2.2
X32	6	0V	GND Input/output D2.3
X32	7	0V	GND Input/output D2.4
X32	8	0V	GND Input/output D2.5
X32	9	0V	GND Input/output D2.6
X32	10	0V	GND Input/output D2.7
X32	11	0V	GND Input/output D3.0
X32	12	0V	GND Input/output D3.1
X32	13	0V	GND Input/output D3.2
X32	14	0V	GND Input/output D3.3
X32	15	0V	GND Input/output D3.4
X32	16	0V	GND Input/output D3.5
X32	17	0V	GND Input/output D3.6
X32	18	0V	GND Input/output D3.7