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MODULÁRNÍ PROGRAMOVATELNÉ AUTOMATY

DIGITAL MODULES TC700

DIGITAL MODULES TC700

1st Edition - March 2004

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1. INTRODUCTION

Digital input modules (Table 1.1) serve for connection of input logic signals from end limit switches and controls of the object being controlled to the programmable logic controller (PLC) TECOMAT TC700.

The modules ensure the conversion of the voltage level at the input to the level of internal signals of the peripheral system and galvanic isolation of the input signals as well as filtering off of faults.

Digital input modules (Table 1.1) serve for controlling of actuators and indication members of an object being controlled. The modules ensure the conversion of the internal voltage levels of the TECOMAT TC700 PLC to the voltage levels for controlling of actuators and indication members as well as galvanic isolation of outputs from internal signals. Logic levels of input and output signals are signalized by green LEDs on the front panel of each module.

The information on module type and their basic parameters can be found on the front plate and module sides. The assignment of signals on the terminals of the module connectors is illustrated on the inside of the door. The supply voltage of each module type has to correspond to the requirements given in chapter 3.

Digital modules in the PLC are unequivocally identified by their position in the rack and by rack address. Digital modules can be fitted at any arbitrary position of both the main and expansion racks.

The IB-7303 input module also optionally allows to initiate interruption, which allows preferential operation of an event. The request for interrupt is possible both with the leading and trailing edge of the input signal (according to module signal). The interrupt can be initiated only by modules fitted in the main frame.

Recommendation: To increase reliability we do not recommend to place relay and triac modules close to central, communication and analog modules.

Table 1.1 List of modules with order numbers

Module type	Modification	Order number
IB-7302	32 inputs 24 V DC, 5 ms, Common pole minus for 8 inputs	TXN 173 02
IB-7303	16 inputs 24 V DC/AC 0,5 ms, interruption, Common pole for 8 inputs	TXN 173 03
IB-7305	16 inputs 230V AC 10 ms, Common pole for 8 inputs	TXN 173 05
OS-7401	16 PNP outputs 24V DC / 2A, Common pole plus	TXN 174 01
OS-7402	32 PNP outputs 24V DC / 0,5A, Common pole plus	TXN 174 02
OS-7405	16 triac outputs 24 – 230 V AC / 0,25A, Common pole for 8 outputs	TXN 174 05
OR-7451	16 relay outputs max. 230V AC / 3A, Common pole for 4 outputs	TXN 174 51
OR-7453	8 relay outputs max. 230V AC / 3A, individual outputs	TXN 174 53

2. MECHANICAL DESIGN

Each module has a plastic protective case 30 mm wide. After opening the door you can access the connectors for signal connection. At the bottom of the unit there is a hole for cables connected to the technology being controlled.

The modules are fitted with connectors, plug-in counterparts of which have screw-type or screwless spring terminals. Taking out of each connector is facilitated by means of locking levers. By moving the locking lever round a slight amount, the terminal becomes loose. When fitting the connector on, the locking lever has to be moved round a slight amount in reverse direction and, for connectors TXN 102 3x, the locking levers serve also to secure the connector against disconnecting.

The connectors are ordered separately and are ready for mechanical encoding. For each module type, a different code is used, so that it is ensured that the user does not interchange the cables by mistake with another connections and does not possibly destroy the module by a higher voltage. Encoding is carried out by means of plastic pins into the connector (according to the instructions for use, which are part of each connector set). The modules are supplied with counterparts of connectors already encoded according to Fig. 2.2.

Fixation of the module on the rack is easy and done by means of a screw located at the top part of the case.

When fixing the module on the rack, the module has to be put with its two lugs at the rear bottom part of the case into the holes at the bottom edge of the metal frame in required position and by swinging movement press the module down onto the connector of the bus and secure it by the screw located at the top side of the case.

When you want to take the module out off the rack, loose the screw at the top part of the case and by swinging movement towards you and down, tilt the module from the rack and take it carefully out of the rack.

ATTENTION! The modules contain parts sensitive to static charge, therefore, it is necessary to follow the safety rules when working with these circuits! Any handling must be done on the module taken out from the rack!

Table 2.1 Dimensions and weights of modules

Dimensions	- height	198 mm
	- width	30 mm
	- depth	137 mm
Weight		0,3 to 0,4 kg (according to type)

ATTENTION! Taking off and plugging in of the peripheral module out of / into the module has to be carried out only when the power supply of the controlled circuits is off.

2.1. CONNECTORS - ENCODING

The connectors are supplied without encoding, the encoding elements are part of the packaging of each connector. The connectors can get a code to avoid the connector to be plugged in another type of connector.

The male connector in the module has already a code from the manufacturer, the peripheral connector is encoded by the customer. The code of each module is given in the basic documentation supplied with the module (the position of the coding element is illustrated by a black rectangle on the figure).

Encoding elements supplied with the connector are designed to be pushed in the grooves of the connector (see Fig. 2.1).

***Encoding procedure*:**

The encoding element is pushed in the direction of arrows ⩤ **BL** ⩥ into the groove of the connector (the elements are different for connectors TXN 102 3x and for connectors TXN 102 40 – two-line elements with raster 3,5 mm). After pushing in the stop position, the rest of the element is broken off (see Fig. 2.1). The same procedure is used for the second side of the encoding element.

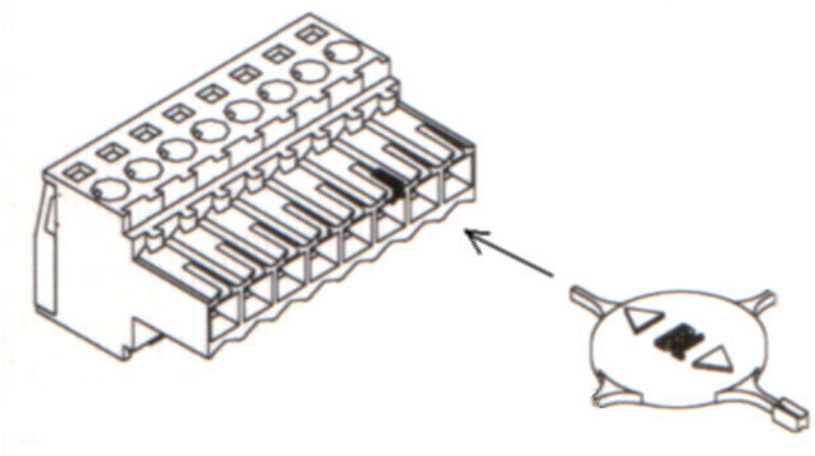
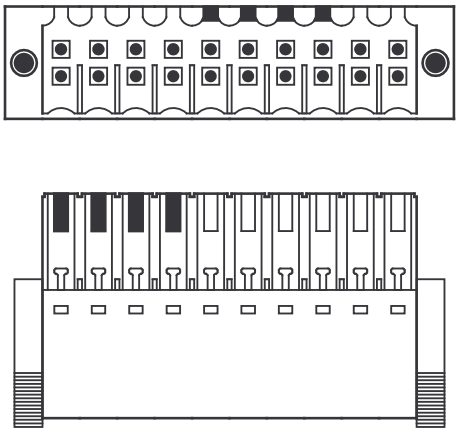
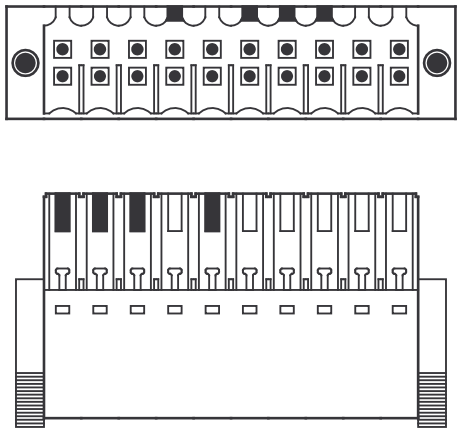


Fig. 2.1 Plugging in of the encoding element into connector body

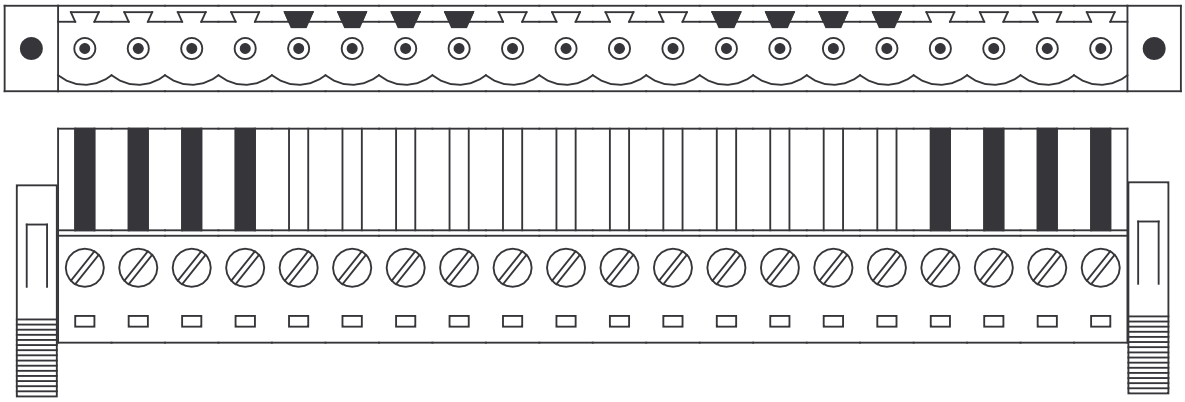
IB-7302



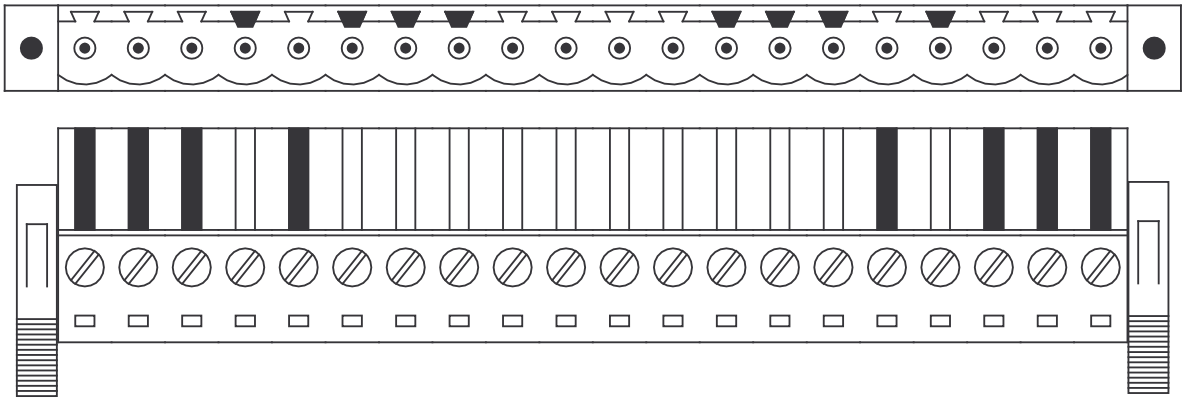
OS-7402



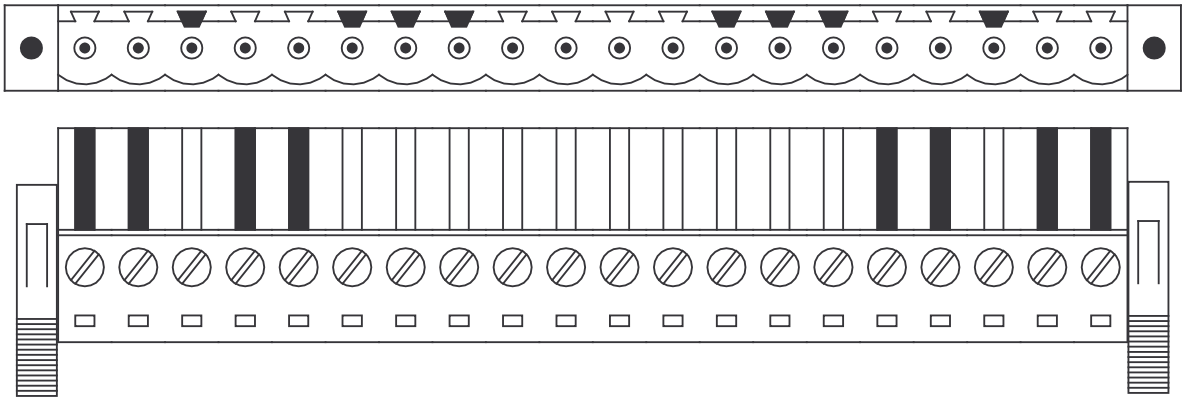
IB-7303



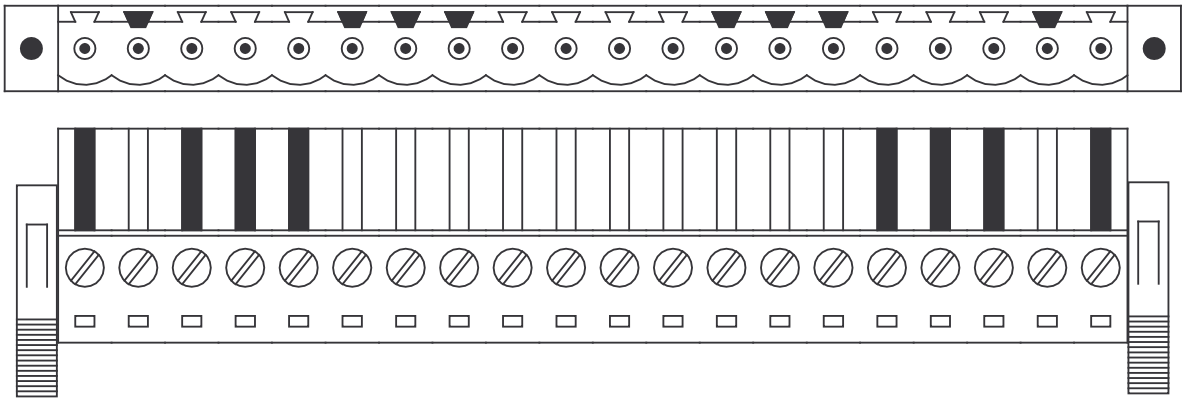
IB-7305



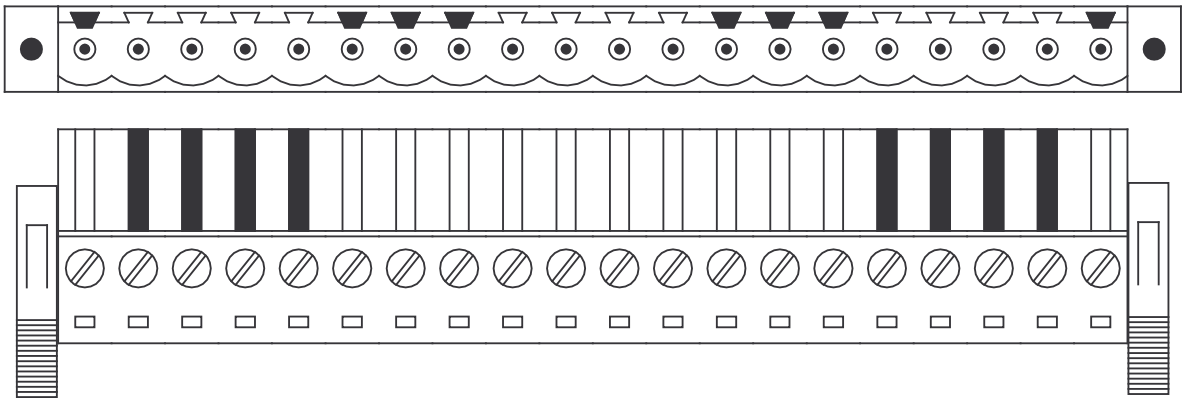
OS-7401



OS-7405



OR-7451



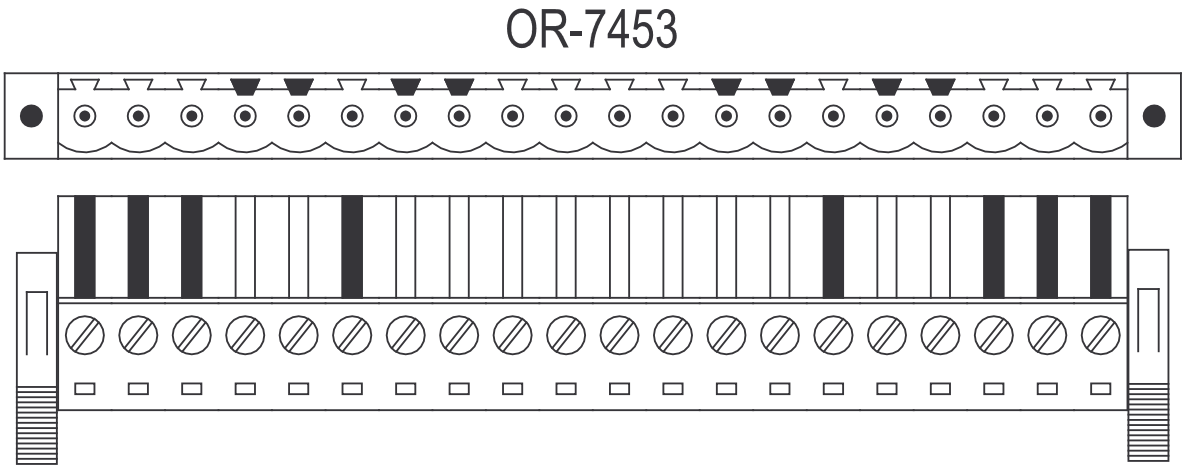


Fig. 2.2 Encoding of peripheral connectors and module male connector (view of the male connectors from the pins, i.e. from the door side)

2.2 CONNECTORS - FEATURES

		Order number of connector set			
		TXN 102 30	**TXN 102 31**	**TXN 102 32**	**TXN 102 40**
No. of connectors in set		1	1	1	2
No. of connector terminals		1x20	1x20	1x20	2x10
Terminal spacing	mm	5,08	5,08	5,08	3,5
Type of terminal		screwless (spring)	Screw, screw in line with conductor	Screw, screw perpendicularly to conductor	screwless (spring)
Length of stripping of conductor	mm	10	13	7	7
Conductor dimensions					
Clamping range	mm^2	0,08 ÷ 2,5	0,08 ÷ 1,5	0,08 ÷ 2,5	0,08 ÷ 1
Wire [1)]	mm^2	0,5 ÷ 2,5	0,5 ÷ 1,5	0,5 ÷ 2,5	0,5 ÷ 1
Cable [2)]	mm^2	0,5 ÷ 2,5	0,5 ÷ 1,5	0,5 ÷ 2,5	0,5 ÷ 1
Cable with female header [3)]	mm^2	0,5 ÷ 2,5	0,5 ÷ 1,5	0,5 ÷ 2,5	–
Cable with female header with plastic collar [4)]	mm^2	0,5 ÷ 1,5	0,5 ÷ 1,5	0,5 ÷ 1,5	–
Nominal voltage	V	250	250	250	80
Nominal current	A	10	10	9	6

[1)] Wire, e.g. harmonized type H05(07) V-U
[2)] Cable, e.g. harmonized type H05(07) V-K
[3)] Cable, with copper cable female header according to DIN 46228/1
[4)] Cable, with cable female header with plastic collar according to DIN 46228/4

3. REQUIREMENT FOR MODULE FEEDING

3.1 FEEDING OF INPUT AND OUTPUT CIRCUITS OF PLC

We recommend to feed the alternating input and output circuits of the PLC from an isolating transformer. An RC member (R = 100 Ω/ 2 W, C = 2 μF / 250 V_{ef}) has to be connected to the secondary winding, from which the output circuits being switched by alternating output modules are fed.

Alternating input circuits have to be fed from a separate secondary winding (no other appliances must be connected to the supply voltage of the input circuits). If necessary, one end of the secondary winding can be connected to the ground terminal of the PLC rack.

Direct input and output circuits are fed from a direct voltage source (e.g. power supply sources of PS series). No other appliances must be connected to the source that could cause the increase of interference or overvoltage level. A permissible tolerance of direct supply voltages including ripple effect for the input and output circuit is 20 per cent from the voltage nominal value. Detailed information can be found in the Manual for designing of systems TECOMAT and TECOREG TXV 001 08.01.

3.1.1 Power supply sources PS-25/24, PS-50/24 and PS-100/24

For feeding of 24 V circuits, power supply sources PS-25/24 (order nr. TXN 070 22), PS-50/24 (order nr. TXN 070 10) or PS-100/24 (order nr. TXN 070 15) can be employed, which serve for feeding of direct current circuits 24 V with the input power of 25 W, 50 W or 100 W, respectively. The power sources are fed from the 230 V AC network. The sources are designed to be installed on the bar.

Table 3.1 Output loss on one input

Unit type	Nominal voltage	Output loss for 1 input
IB-7302	24 V DC	0,09 W
IB-7303	24 V DC/AC	0,2 W
IB-7305	230 V AC	0,25 W

Table 3.2 Output loss on one output

Unit type	Nominal voltage	Input current	Output loss for 1 input
OS-7401	24 V DC	2 A	0,35 W
OS-7402	24 V DC	0,5 A	0,1 W
OS-7405	115 - 230 V AC	0,25 A	0,3 W

3.2 PREVENTATIVE PROTECTION AGAINST INTERFERENCE

To reduce the level of interference in the distributing frame with the installed PLC, all the inductive loads have to be treated with interference elimination devices. For this purpose, interference elimination units are delivered (Table 3.3, Table 3.4).

3.2.1 Use of interference elimination unit

The interference elimination unit serves for protecting of the digital direct as well as alternating output units of the PLC against voltage peaks that occur especially when controlling inductive load. Though some units have this protection on the board, we recommend to do this protection straight on the load. This is due to maximum avoidance of interference spreading as a source of possible faults.

As protective member we deliver varistors or RC-members, the highest efficiency can be reached by combination of both protection types. The unit can be used anywhere in controlled technologies to protect contacts or against interferences arising during control processes.

Table 3.3 Interference elimination units

Interference elimination unit content	For load	Unit order number
8x varistor 24 V	24 V DC/AC	TXF 680 00
8x varistor 48 V	48 V DC/AC	TXF 680 01
8x varistor 115 V	115 V AC	TXF 680 02
8x varistor 230 V	230 V AC	TXF 680 03
8x RC member - R = 10Ω, C = 0,47µF	24 - 48 V DC/AC	TXF 680 04
8x RC member - R = 47Ω, C = 0,1µF	115 - 230 V AC	TXF 680 05

Table 3.4 Parameters of varistors used in interference elimination units

Energy that can be captured by the varistor I^2t (t is for duration of the blanking pulse - in ms)	< 80
Current through varistor I	< 25 A
Mean value of output power loss P	< 0,6 W

Protection element connection

An example of connection is given on Fig. 3.1. The principles of interference elimination in the position of its source as close as possible have to be taken in account.

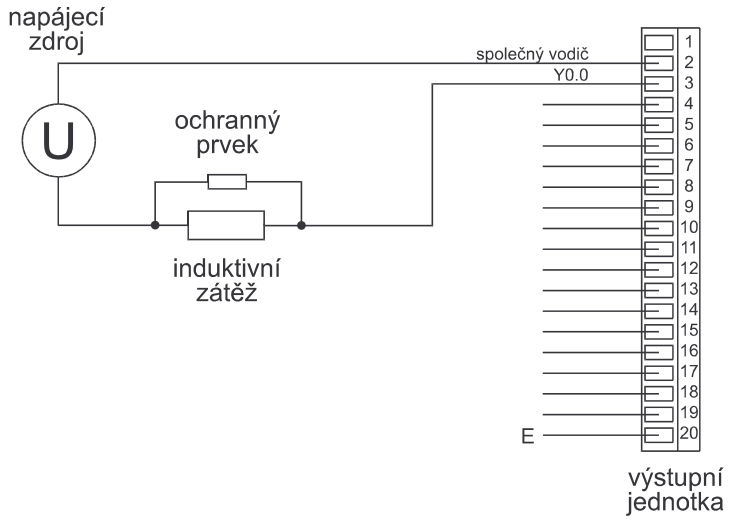


Fig. 3.1 Protective member connection parallel to the load

Further information on interference elimination can be found in the Manual for designing of systems TECOMAT and TECOREG TXV 001 08.01, section 7.3.

4. DIGITAL INPUT MODULE IB-7302

The module IB-7302 is designed for scanning of up to 32 digital signals 24 V DC with a common minus pole, type 1. The module is fitted with two connectors (set TXN 102 40, they are ordered separately) with screwless terminals on which always 16 inputs are terminated. The module is equipped with intelligent input circuits requiring connection of external supply voltage of 24 V DC.

4.1 BASIC PARAMETERS

Product standard	ČSN EN 61131-2
Protection class of electrical object ČSN 33 0600	III
Connection	Screwless terminals, max. 1,0 mm^2 conductor per terminal
Type of equipment	Built-in
Coverage (after installation into rack)	IP20 ČSN EN 60529
Dimensions	137 x 30 x 198 mm

4.2 OPERATIONAL CONDITIONS

Class of ambient influence – ČSN 33 2000-3	Normal
Operating temperatures range	0 °C to + 55 °C
Permissible temperatures during transport	-25 °C to +70 °C
Relative humidity	10 % to 95 % without condensation
Atmospheric pressure	min. 70 kPa (< 3000 m above see level)
Degree of pollution - ČSN EN 61131-2	2
Overvoltage category of installation - ČSN 33 0420-1	II
Working position	Vertical
Type of operation	Continuous
Electromagnetic compatibility	
Emissions - ČSN EN 55022*	Class A
Immunity	Table 16, ČSN EN 61131-2
Vibration resistance (sinusoidal vibrations) Fc according to ČSN EN 60068-2-6	10 Hz to 57 Hz amplitude 0,075 mm, 57 Hz to 150 Hz acceleration 1G

* This is a product of Class A. In indoor conditions (i.e. such conditions, where using of radio and TV sets can be supposed in a distance of 10 m from the mentioned equipment), the product can cause radio disturbances. It might be required in such cases that the user takes necessary measures to avoid this.

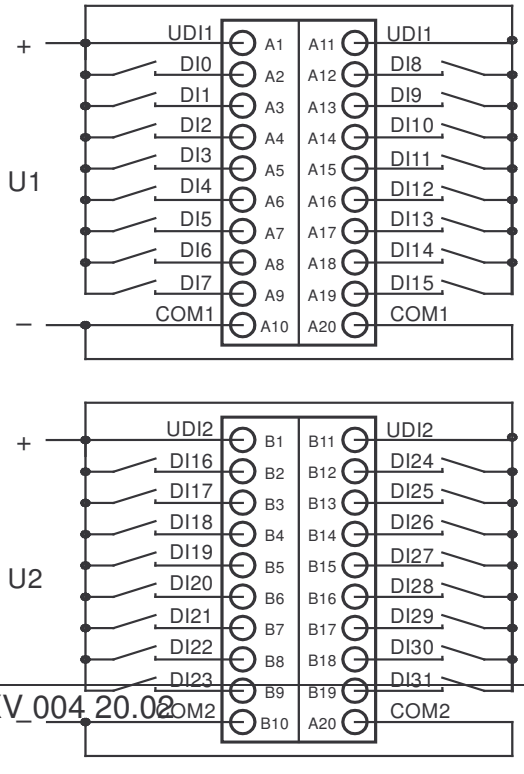
4.3 ELECTRICAL PARAMETERS

Number of inputs		32
Number of inputs in the group		16 (in two groups)
Galvanic isolation from internal circuits		Yes, groups and mutually
Diagnostics		Yes, signalization of energized input on module panel
Common pole		Minus
Type of inputs		Type 1
Input voltage		
for log. 0 (UL)	Max.	5 V DC
	Min.	- 15 V DC
for log. 1 (UH)	Min.	15 V DC
	Typ.	24 V DC
	Max.	30 V DC
Input current at log. 1	Typ.	3 mA
Delay from log. 0 to log. 1		5 ms
Delay from log. 1 to log. 0		5 ms
External supply voltage of input modules of module		24 V DC
Max. consumption from external source (one group)		60 mA
Insulation voltage among inputs and internal circuits		500 V DC
Insulation voltage among groups of inputs among each other		500 V DC
Module output loss	Max.	4 W
Module input power taken from system source	Max.	1,8 W

4.4 POWER SUPPLY

The internal circuits of the module are fed from the power supply source, which is part of the TC700 system assembly.

4.5 CONNECTION



The module is fitted with two identical screwless connectors (order number of connector set TXN 102 40).

UDIx	input of supply voltage +24 V DC for module internal circuits
COMx	common terminal of input circuits and feeding of input circuits
DIx	input terminal of input x

Fig. 4.1 Connection of terminal board of module IB-7302

Detailed information on connection, proper installation procedure, examples of module connection and principles for increasing resistance and reliability can be found in the handbook for designing TXV 001 08.01.

4.6 OPERATION

4.6.1 Module HW configuration

The module is operated, set and diagnosed from the MOSAIC development environment. No setup is made on the module itself.

4.6.2 Putting in operation

After putting the module into the rack and switching power supply on, the module is fully ready for operation and does not require any other settings of its elements.

4.7 DIAGNOSTICS

The basic diagnostic system of the module is part of the standard module software. The diagnostic system becomes active after module power supply is on, and works independently from the user.

4.8 INDICATION

On the front panel, each input digital signal is assigned one green indication LED. If this LED is on, it indicates the presence of an input signal on the given terminal. Further, there is a green RUN LED on the front panel. If the RUN LED is on,, the module is in the HALT mode, if the RUN LED is flashing, the module is in the RUN mode.

Fig. 4.2 Indication panel of module IB-7302

4.9 MODULE SETUP

For a trouble-free module operation it is necessary to perform its SW setup within the frame of module declaration. The activation of the operation of digital inputs is carried out by figures of eight. Each figure of eight can be enabled or disabled to be operated. Further, for each figure of eight, detection of short pulses to log. 0 or to log. 1 can be set. Module setup is carried out within the MOSAIC development environment by means of the dialog given below.

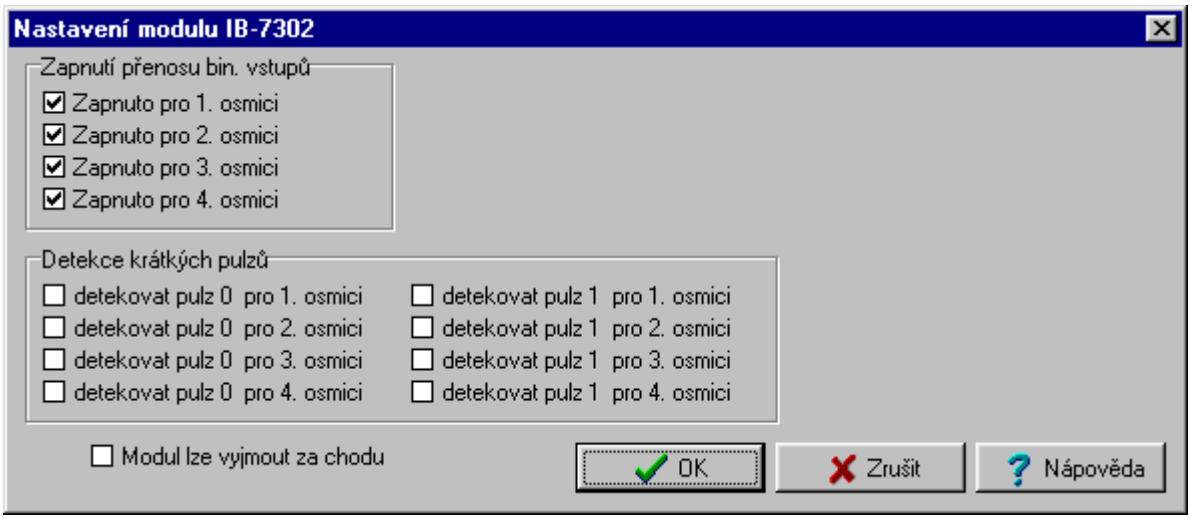


Fig. 4.3 Module SW setup

Switching on of transmission of digital inputs

By enabling the option *Zapnuto pro n. osmici* (ON for the n-th figure of eight), transmission of current states of the corresponding figure of eight of inputs into the PLC scratchpad is allowed. If this option is not enabled for a figure of eight, the relevant values will not be transmitted and they do not appear in the PLC scratchpad. The first figure of eight corresponds to the inputs DI0 ÷ DI7, the second figure of eight corresponds to the inputs DI8 ÷ DI15, the third figure of eight corresponds to the inputs DI16 ÷ DI23, the fourth figure of eight corresponds to the inputs DI24 ÷ DI31.

Detection of short pulses

By enabling the option *Detekovat pulz 0 pro n. osmici* (Detect pulse 0 for the n-th figure of eight), the function of short pulse interception to log. 0 is activated. By enabling the option *Detekovat pulz 1 pro n. osmici* (Detect pulse 1 for the n-th figure of eight), the function of short pulse interception to log. 1 is activated.

If an input signal is to be intercepted, which is mainly in the state of log. 1 and pulses to log. 0 appear on the signal, which are shorter than the longest possible cycle time of the PLC, then these pulses could be lost, since only the states of the inputs at the moment of the I/O scan of the central unit are standardly transmitted to the PLC. If we enable the detection of short pulses for the state of log. 0, then the input module reads the corresponding input much more frequently (approx. 6 ms), executes logical product of read values, which is then sent to the central unit as the resulting value of the input. If the value of log. 0 appears on the input during the cycle, it will be held in the module memory till the next data transmission to the central unit, even if the value of log. 1 is already on the input at the moment of data transmission. The same is valid analogically for the input signal, which is mainly in the state of log. 0 and short pulses to

log. 1 appear on the signal. We enable the detection of short pulses for the state of log. 1 and the input module then executes the logical product of the read values of the input.

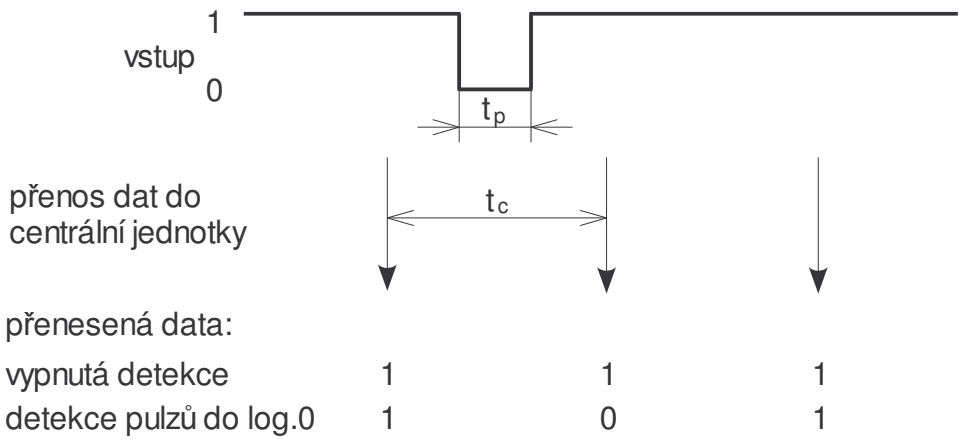


Fig. 4.4 Function of detection of short pulses to log. 0

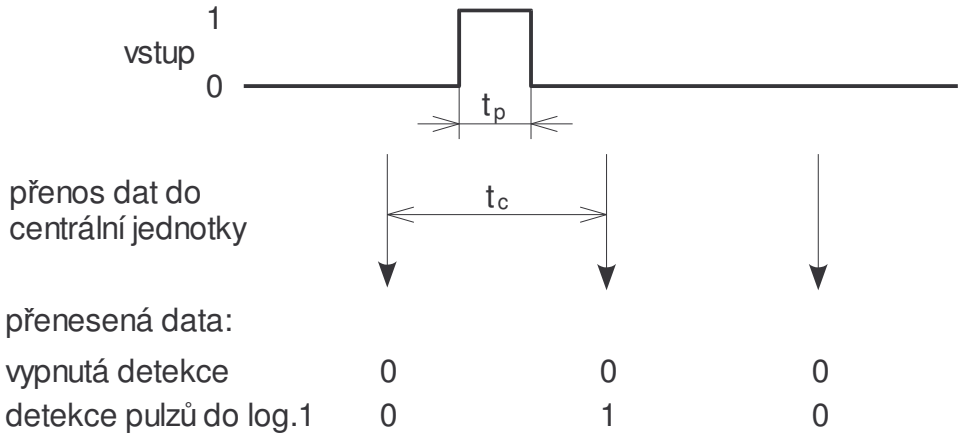
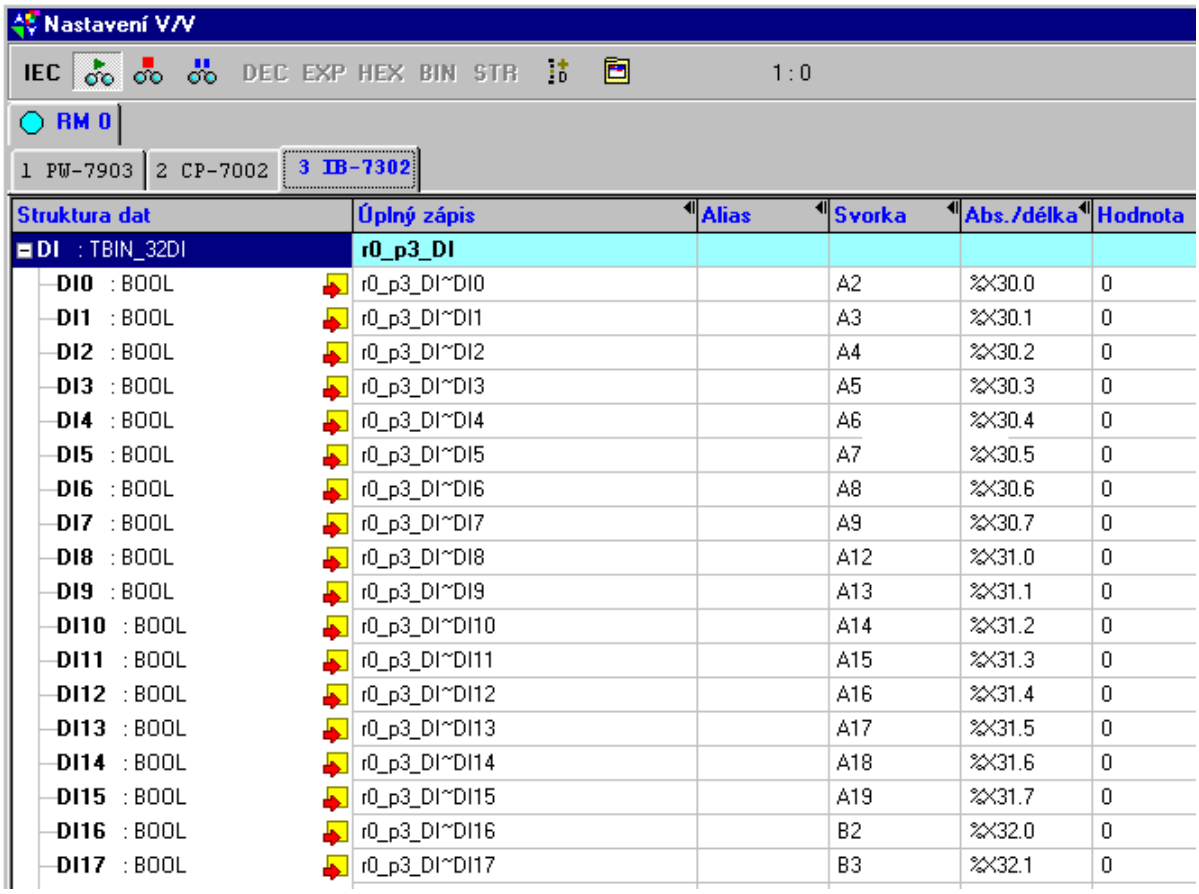


Fig. 4.5 Function of detection of short pulses to log. 1

For the a. m. figures, the following relation is valid: $t_c > t_p > 6ms$.

4.10 INPUT DATA STRUCTURE

The digital input module IB-7302 operates 32 input digital signals. In the data being transmitted, each input signal is represented by one variable of Boolean type. The structure items of the digital module have symbolic names assigned, beginning with the rack number and position number in the rack. In the column *Úplný zápis (Full Write)*, concrete symbolic name is specified for the given item. If you want to use the data in the user program, you will use either this symbolic name or you will write your symbolic name in the column *Alias*, that can be used later. Do not use absolute operands in any case, since they can change after a new compilation of the user program. The structure of passed data is obvious from the panel *Nastavení V/V (Setting V/V)* in the MOSAIC development environment (icon IO).



Struktura dat	Úplný zápis	Alias	Svorka	Abs./délka	Hodnota
DI : TBIN_32DI	r0_p3_DI				
DI0 : BOOL	r0_p3_DI~DI0		A2	%X30.0	0
DI1 : BOOL	r0_p3_DI~DI1		A3	%X30.1	0
DI2 : BOOL	r0_p3_DI~DI2		A4	%X30.2	0
DI3 : BOOL	r0_p3_DI~DI3		A5	%X30.3	0
DI4 : BOOL	r0_p3_DI~DI4		A6	%X30.4	0
DI5 : BOOL	r0_p3_DI~DI5		A7	%X30.5	0
DI6 : BOOL	r0_p3_DI~DI6		A8	%X30.6	0
DI7 : BOOL	r0_p3_DI~DI7		A9	%X30.7	0
DI8 : BOOL	r0_p3_DI~DI8		A12	%X31.0	0
DI9 : BOOL	r0_p3_DI~DI9		A13	%X31.1	0
DI10 : BOOL	r0_p3_DI~DI10		A14	%X31.2	0
DI11 : BOOL	r0_p3_DI~DI11		A15	%X31.3	0
DI12 : BOOL	r0_p3_DI~DI12		A16	%X31.4	0
DI13 : BOOL	r0_p3_DI~DI13		A17	%X31.5	0
DI14 : BOOL	r0_p3_DI~DI14		A18	%X31.6	0
DI15 : BOOL	r0_p3_DI~DI15		A19	%X31.7	0
DI16 : BOOL	r0_p3_DI~DI16		B2	%X32.0	0
DI17 : BOOL	r0_p3_DI~DI17		B3	%X32.1	0

Fig. 4.6 Data structure of digital module IB-7302

The module data structure is generated by the Mosaic program automatically (according to Setup V/V) to file HWconfig.ST.

```
TYPE
  TBIN_32DI : STRUCT
    DI0    : BOOL;
    DI1    : BOOL;
    DI2    : BOOL;
    DI3    : BOOL;
    DI4    : BOOL;
    DI5    : BOOL;
    DI6    : BOOL;
    DI7    : BOOL;
    DI8    : BOOL;
    DI9    : BOOL;
    DI10   : BOOL;
    DI11   : BOOL;
    DI12   : BOOL;
    DI13   : BOOL;
    DI14   : BOOL;
    DI15   : BOOL;
    DI16   : BOOL;
    DI17   : BOOL;
    DI18   : BOOL;
    DI19   : BOOL;
    DI20   : BOOL;
    DI21   : BOOL;
```

```
    DI22  : BOOL;
    DI23  : BOOL;
    DI24  : BOOL;
    DI25  : BOOL;
    DI26  : BOOL;
    DI27  : BOOL;
    DI28  : BOOL;
    DI29  : BOOL;
    DI30  : BOOL;
    DI31  : BOOL;
  END_STRUCT;
END_TYPE


VAR_GLOBAL
  r0_p3_DI              AT %X30  : TBIN_32DI;
END_VAR
```

Variable DI

The value passed in variable DIx corresponds to the state of the input signal of the corresponding digital input.

4.11 APPENDIX FOR ADVANCED USERS

The structures given below are typically automatically generated by the MOSAIC development environment (into file *.HWC) and it is not recommended to alter them. If the programmer does not use automatic configuration generation, the description below serves as a sample for manual module configuration.

4.11.1 Initialization data structure

The module requires an initialization table, this is represented in the declaration file of the MOSAIC development environment (*.HWC) by the following description:

```
#struct _TTS_Head                ;module heading structure
        UINT  ModulID,           ;module type identification code
        USINT Stat0,             ;status of data exchange
        USINT Stat1              ;status of data exchange

#struct _TTS_IB7302              ;module initialization table structure
        _TTS_Head Head,          ;table heading
        USINT[4]  EDI,           ;activation of figures of eight of the input
        USINT     FLT,           ;filtering activation - not used
        USINT     EDG            ;short pulse detection activation
```

Example of declaration of initialization table :

```
#table _TTS_IB7302 _r0_p3_Table = 7302,$00,$00,     ;table heading
                                  $80,$80,$80,$80,  ;activation of figures of
                                                    ;eight of the input
```

```
                                $00,            ;filtering
                                $00             ;short pulses
```

Example of declaration of module :

```
#struct TModulE1                ;module declaration structure
        USINT version,          ;description version
        USINT rack,             ;rack address
        USINT address,          ;module address in the rack
        UINT  LogAddress,       ;logic address
        UINT  LenInputs,        ;length of input data zone
        UINT  LenOutputs,       ;length of output data zone
        DINT  OffsetInputs,     ;position of input data zone
        DINT  OffsetOutputs,    ;position of output data zone
        UINT  InitTable         ;initialization table index

#module TModulE1 1, 0, 3, 0, 4, 0, __offset(r0_p3_DI), 0,
 __indx (_r0_p3_Table)
```

The meanings of the items of the initialization table:

ModulID - module type identification code, here 7302

STAT0,STAT1 - data exchange status, here 0

EDI - activation of operation of the figure of eight of digital inputs
= $80 - the figure of eight of inputs will be operated
= $00 - the figure of eight of inputs will not be operated

FLT - for module IB-7302 not used

EDG - short pulse detection

EDG

LP3	SP3	LP2	SP2	LP1	SP1	LP0	SP0
.7	.6	.5	.4	.3	.2	.1	.0

SPn - short pulse detection for a figure of eight n
= 1 - enabled
= 0 - disabled

LPn - detected level of short pulse
= 1 - detect short pulses to the level of logic 1
= 0 - detect short pulses to the level of logic 0

4.12 MODULE CONNECTION EXAMPLES

5. DIGITAL INPUT MODULE IB-7303

The IB-7303 module is designed for scanning of up to 16 digital signals 24 V DC / AC with a common pole (according to connection minus, plus or alternating feeding), type 1. The module is fitted with a connector allowing the customer to make a choice of several variants selected and ordered separately by the customer (order numbers TXN 102 3x). The connectors are described in the documentation TXV 102 30 or in the Manual for designing TXV 001 08.01.

5.1 BASIC PARAMETERS

Product standard	ČSN EN 61131-2
Protection class of electrical object ČSN 33 0600	III
Connection	Removable connector, max. 2,5 mm2 conductor per terminal
Type of equipment	Built-in
Coverage (after installation into rack)	IP20 ČSN EN 60529
Dimensions	137 x 30 x 198 mm

5.2 OPERATIONAL CONDITIONS

Class of ambient influence – ČSN 33 2000-3	Normal
Operating temperatures range	0 °C to + 55 °C
Permissible temperatures during transport	-25 °C to +70 °C
Relative humidity	10 % to 95 % without condensation
Atmospheric pressure	min. 70 kPa (< 3000 m above see level)
Degree of pollution - ČSN EN 61131-2	2
Overvoltage category of installation - ČSN 33 0420-1	II
Working position	Vertical
Type of operation	Continuous
Electromagnetic compatibility	
Emissions - ČSN EN 55022*	Class A
Immunity	Table 16, ČSN EN 61131-2
Vibration resistance (sinusoidal vibrations) Fc according to ČSN EN 60068-2-6	10 Hz to 57 Hz amplitude 0,075 mm, 57 Hz to 150 Hz acceleration 1G

* This is a product of Class A. In indoor conditions (i.e. such conditions, where using of radio and TV sets can be supposed in a distance of 10 m from the mentioned equipment), the product can cause radio disturbances. It might be required in such cases that the user takes necessary measures to avoid this.

5.3 ELECTRICAL PARAMETERS

Number of inputs	16
Number of inputs in the group	8 (in two groups)
Galvanic isolation from internal circuits	Yes, groups and mutually
Diagnostics	Yes, signalization of energized input on module panel

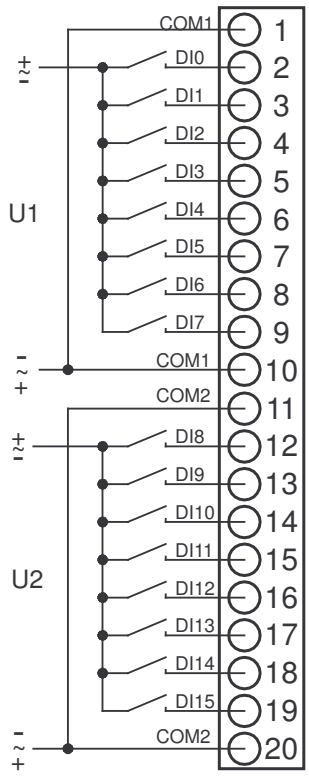
Common pole		Accord. to polarity of connection (minus, plus alternating feeding)	
Type of inputs		Type 1	
Common pole		Minus	Plus
Input voltage			
for log. 0 (UL)	Max.	5 V DC	- 5 V DC
	Min.	- 5 V DC	5 V DC
for log. 1 (UH)	Min.	15 V DC / AC	- 15 V DC / AC
	Typ.	24 V DC / AC	-24 V DC / AC
	Max.	30 V DC / AC	- 30 V DC / AC
Input current at log. 1	Typ.	5 mA	
Delay from log. 0 to log. 1 (without filtering)		0,5 ms	
Delay from log. 1 to log. 0 (without filtering)		0,5 ms	
External supply voltage of input modules of module		24 V DC / AC	
Max. consumption from external source (one group)		50 mA	
Insulation voltage among inputs and internal circuits		500 V DC	
Insulation voltage among groups of inputs among each other		500 V DC	
Module output loss	Max.	4 W	
Module input power taken from system source	Max.	1 W	

5.4 POWER SUPPLY

The module is fed from the power supply source, which is part of the TC700 system assembly.

5.5 CONNECTION

The module is fitted with a removable connector (order number of connectors TXN 102 3x). The connection of connectors is illustrated on Fig. 5.1.



COMx	common terminal of input circuits and feeding of input circuits
DIx	input terminal of input x

Fig. 5.1 Connection of terminal board of module IB-7303

Detailed information on connection, proper installation procedure, examples of module connection and principles for increasing resistance and reliability can be found in the handbook for designing TXV 001 08.01.

5.6 OPERATION

5.6.1 Module HW configuration

The module is operated, set and diagnosed from the MOSAIC development environment. No setup is made on the module itself.

5.6.2 Putting in operation

After putting the module into the rack and switching power supply on, the module is fully ready for operation and does not require any other settings of its elements.

5.7 DIAGNOSTICS

The basic diagnostic system of the module is part of the standard module software. The diagnostic system becomes active after module power supply is on, and works independently from the user.

5.8 INDICATION

On the front panel, each input digital signal is assigned one green indication LED. If this LED is on, it indicates the presence of an input signal on the given terminal. Further, there is a green

RUN LED on the front panel. If the RUN LED is on,, the module is in the HALT mode, if the RUN LED is flashing, the module is in the RUN mode.

Fig. 5.2 Indication panel of module IB-7303

5.9 MODULE SETUP

For a trouble-free module operation it is necessary to perform its SW setup within the frame of module declaration. The activation of the operation of digital inputs is carried out by figures of eight. Each figure of eight can be enabled or disabled to be operated. Further, for each figure of eight, detection of short pulses, filtering and possibility of interrupt initialization from any input or edge can be set. Module setup is carried out within the MOSAIC development environment by means of the dialog given below.

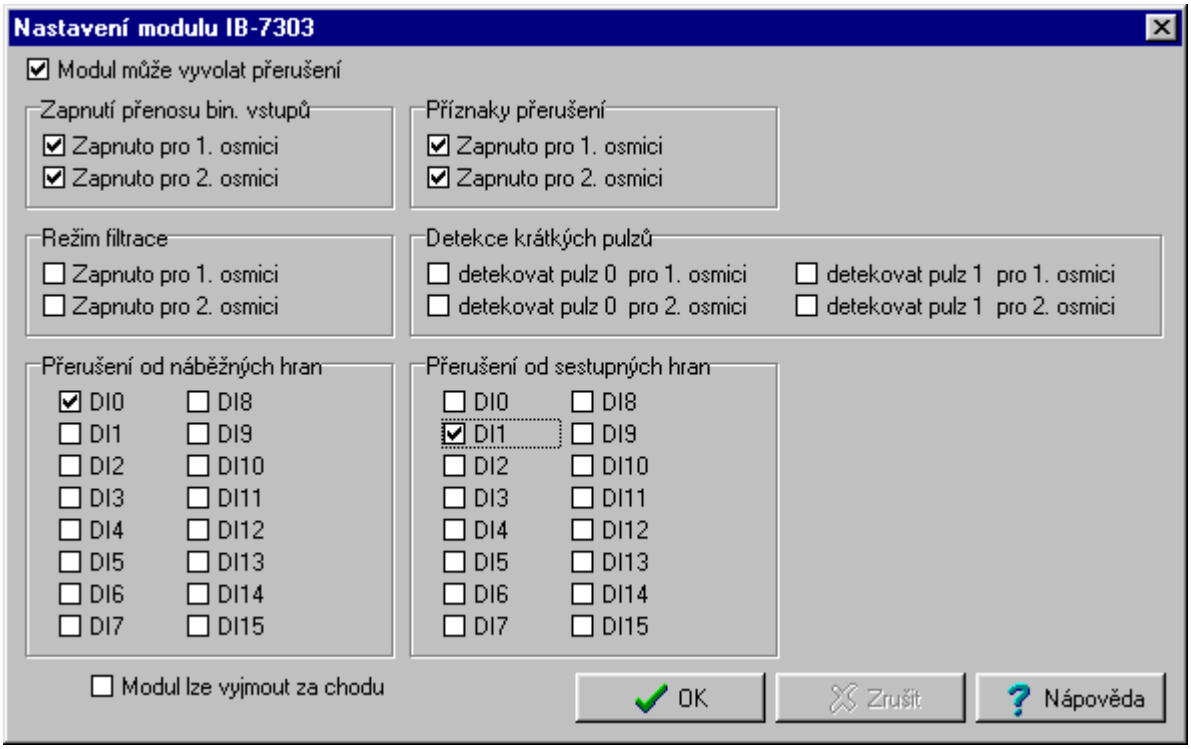


Fig. 5.3 Module SW setup

The module can initiate interrupt

By enabling this option we allow the module to initiate the P42 interrupt process under the conditions set in the blocks *Přerušení od náběžných hran* a *Přerušení od sestupných hran* (Interrupt from leading edges and Interrupt from trailing edges).

Switching on of the transmission of digital inputs

By enabling the option *Zapnuto pro n. osmici (ON for the n-th figure of eight)*, we allow the transmission of the current states of the corresponding figure of eight to the PLC scratchpad. If this option is not enabled for a figure of eight of the inputs, the relevant values are not transmitted and they do not appear in the PLC scratchpad. The first figure of eight corresponds to the inputs DI0 ÷ DI7, the second figure of eight corresponds to the inputs DI8 ÷ DI15.

Flags of interrupt

By enabling the option *Zapnuto pro n. osmici (ON for the n-th figure of eight)*, we allow the transmission of interrupt flags of the corresponding figure of eight of the inputs to the PLC scratchpad. If this option is not enabled for a figure of eight of the inputs, the relevant values are not transmitted and they do not appear in the PLC scratchpad. These options are available only when the option *Modul může vyvolat přerušení (Module can initiate interrupt)* is enabled.

Filtering mode

By enabling the option *Zapnuto pro n. osmici (ON for the n-th figure of eight)*, we activate the function of the alternating part on the corresponding figure of eight of inputs. On this figure of eight of inputs, alternating voltage with a frequency of 50 Hz can be then connected. If we connect direct voltage to the inputs with active filtering, the inputs will be in operation, too, but the transmission of the current state from the input to the PLC will be slowed down and the pulses shorter than 4 ms will be suppressed.

Short pulse detection

By enabling the option *Detekovat pulz 0 pro n. osmici* (Detect pulse 0 for the n-th figure of eight), the function of short pulse interception to log. 0 is activated. By enabling the option *Detekovat pulz 1 pro n. osmici* (Detect pulse 1 for the n-th figure of eight), the function of short pulse interception to log. 1 is activated.

If we have an input signal, which is mainly in the state of log. 1 and pulses to log. 0 appear on the signal, which are shorter than the longest possible cycle time of the PLC, then these pulses could be lost, since only the states of the inputs at the moment of the I/O scan of the central unit are standardly transmitted to the PLC.

If we enable the detection of short pulses for the state of log. 0, then the input module reads the corresponding input much more frequently (approx. 1 ms without filtering and approx. 5 ms with filtering), executes logical product of read values, which is then sent to the central unit as the resulting value of the input. If the value of log. 0 appears on the input during the cycle, it will be held in the module memory till the next data transmission to the central unit, even if the value of log. 1 is already on the input at the moment of data transmission.

The same is valid analogically for the input signal, which is mainly in the state of log. 0 and short pulses to log. 1 appear on the signal. We enable the detection of short pulses for the state of log. 1 and the input module then executes the logical product of the read values of the input.

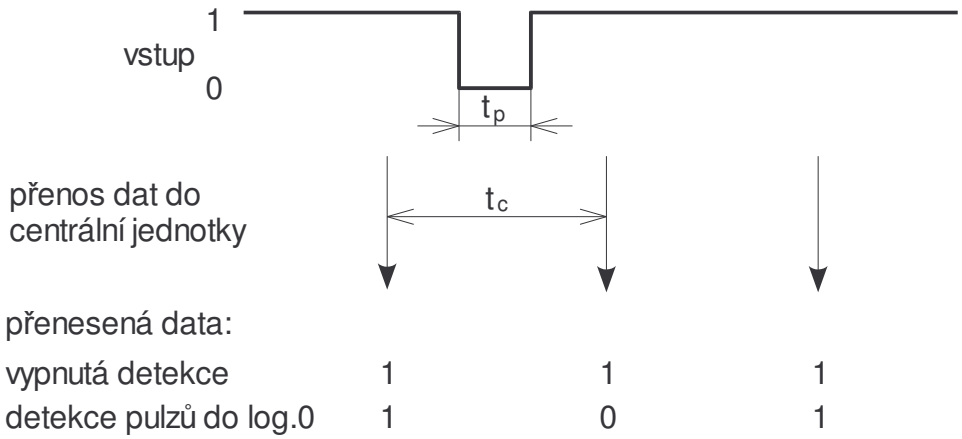


Fig. 5.4 Function of detection of short pulses to log. 0

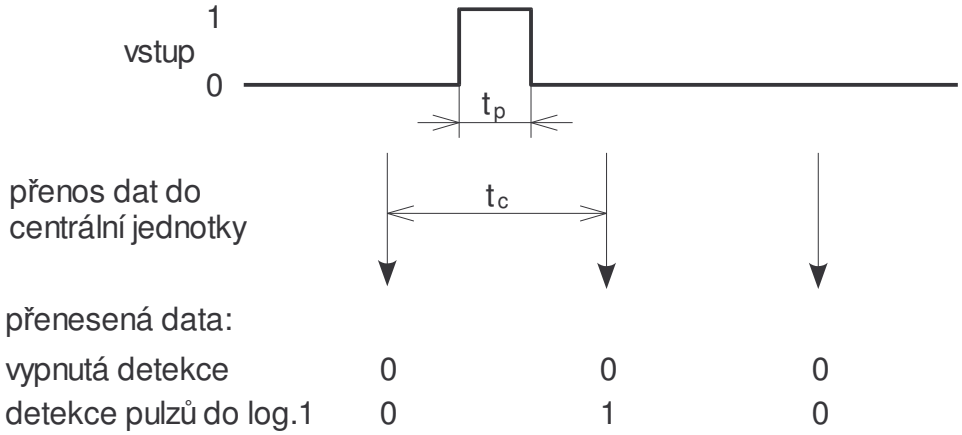


Fig. 5.5 Function of detection of short pulses to log. 1

For the a. m. figures, the following relation is valid: $t_c > t_p > 1ms$ (without filtering) a $t_c > t_p > 5ms$ (with filtering).

Interruption from leading edges

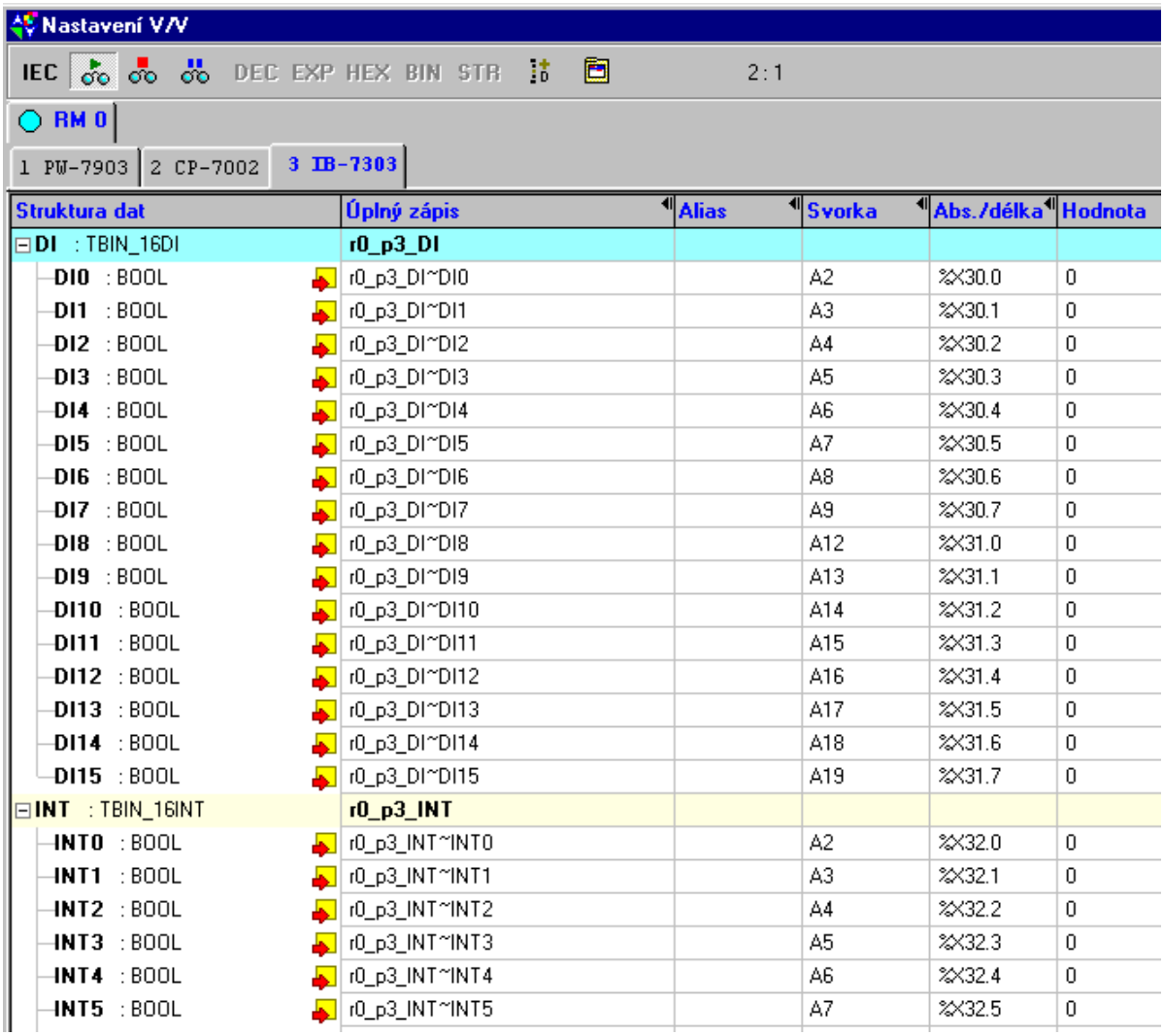
Interruption from trailing edges

By enabling of the corresponding input we define, which inputs during which change of signal are to initiate the P42 interrupt process. For one input, also both edges can be enabled at the same time. The information on which input initiated the interrupt can be found from the flags of the interrupt transmitted to the PLC scratchpad as part of data provided by the IB-7303 module. These options are available only when the option *Modul může vyvolat přerušení (Module can initiate interrupt)* is enabled.

5.10 INPUT DATA STRUCTURE

The digital input module IB-7303 operates 16 input digital signals. In the data being transmitted, each input signal is represented by one variable of Boolean type. In case that the interrupt from input signals is enabled, the flag of localization of the source of interrupt is also indicated in the transmitted data. The structure items of the digital module have symbolic names

assigned, beginning with the rack number and position number in the rack. In the column *Úplný zápis (Full Write)*, concrete symbolic name is specified for the given item. If you want to use the data in the user program, you will use either this symbolic name or you will write your symbolic name in the column *Alias*, that can be used later. Do not use absolute operands in any case, since they can change after a new compilation of the user program. The structure of passed data is obvious from the panel *Nastavení V/V (Setting V/V)* in the MOSAIC development environment (icon IO).



Struktura dat	Úplný zápis	Alias	Svorka	Abs./délka	Hodnota
DI : TBIN_16DI	r0_p3_DI				
DI0 : BOOL	r0_p3_DI~DI0		A2	%X30.0	0
DI1 : BOOL	r0_p3_DI~DI1		A3	%X30.1	0
DI2 : BOOL	r0_p3_DI~DI2		A4	%X30.2	0
DI3 : BOOL	r0_p3_DI~DI3		A5	%X30.3	0
DI4 : BOOL	r0_p3_DI~DI4		A6	%X30.4	0
DI5 : BOOL	r0_p3_DI~DI5		A7	%X30.5	0
DI6 : BOOL	r0_p3_DI~DI6		A8	%X30.6	0
DI7 : BOOL	r0_p3_DI~DI7		A9	%X30.7	0
DI8 : BOOL	r0_p3_DI~DI8		A12	%X31.0	0
DI9 : BOOL	r0_p3_DI~DI9		A13	%X31.1	0
DI10 : BOOL	r0_p3_DI~DI10		A14	%X31.2	0
DI11 : BOOL	r0_p3_DI~DI11		A15	%X31.3	0
DI12 : BOOL	r0_p3_DI~DI12		A16	%X31.4	0
DI13 : BOOL	r0_p3_DI~DI13		A17	%X31.5	0
DI14 : BOOL	r0_p3_DI~DI14		A18	%X31.6	0
DI15 : BOOL	r0_p3_DI~DI15		A19	%X31.7	0
INT : TBIN_16INT	r0_p3_INT				
INT0 : BOOL	r0_p3_INT~INT0		A2	%X32.0	0
INT1 : BOOL	r0_p3_INT~INT1		A3	%X32.1	0
INT2 : BOOL	r0_p3_INT~INT2		A4	%X32.2	0
INT3 : BOOL	r0_p3_INT~INT3		A5	%X32.3	0
INT4 : BOOL	r0_p3_INT~INT4		A6	%X32.4	0
INT5 : BOOL	r0_p3_INT~INT5		A7	%X32.5	0

Fig. 5.6 Data structure of digital module IB-7303

The module data structure is generated by the Mosaic program automatically (according to Setup V/V) to file HWconfig.ST.

```
TYPE
   TBIN_16DI : STRUCT
    DI0  : BOOL;
    DI1  : BOOL;
    DI2  : BOOL;
    DI3  : BOOL;
    DI4  : BOOL;
    DI5  : BOOL;
    DI6  : BOOL;
    DI7  : BOOL;
```

```
    DI8   : BOOL;
    DI9   : BOOL;
    DI10   : BOOL;
    DI11   : BOOL;
    DI12   : BOOL;
    DI13   : BOOL;
    DI14   : BOOL;
    DI15   : BOOL;
  END_STRUCT;

  TBIN_16INT : STRUCT
    INT0   : BOOL;
    INT1   : BOOL;
    INT2   : BOOL;
    INT3   : BOOL;
    INT4   : BOOL;
    INT5   : BOOL;
    INT6   : BOOL;
    INT7   : BOOL;
    INT8   : BOOL;
    INT9   : BOOL;
    INT10   : BOOL;
    INT11   : BOOL;
    INT12   : BOOL;
    INT13   : BOOL;
    INT14   : BOOL;
    INT15   : BOOL;
  END_STRUCT;
END_TYPE


VAR_GLOBAL
  r0_p3_DI              AT %X30   : TBIN_16DI;
  r0_p3_INT             AT %X32   : TBIN_16INT;
END_VAR
```

Variable DI

The value passed in variable DIx corresponds to the state of the input signal of the corresponding digital input.

Variable INT

The value passed in variable INTx indicates a request for interrupt from the corresponding digital input. At the same time, the P42 interrupt process of the user program is initiated, when operation of the state occurred is performed. Detail of the process P42 can be found in documentation TXV 001 09 Programmer's manual PLC Tecomat, section 10.5 Interrupt processes.

5.11 APPENDIX FOR ADVANCED USERS

The structures given below are typically automatically generated by the MOSAIC development environment (into file *.HWC) and it is not recommended to alter them. If the programmer does not use automatic configuration generation, the description below serves as a sample for manual module configuration.

5.11.1 Initialization data structure

The module requires an initialization table, this is represented in the declaration file of the MOSAIC development environment (*.HWC) by the following description:

```
#struct _TTS_Head                ;module heading structure
        UINT  ModulID,           ;module type identification code
        USINT Stat0,             ;status of data exchange
        USINT Stat1              ;status of data exchange

#struct _TTS_MINTRTF
        USINT MINTR,             ;setup of interruption from leading edges
        USINT MINTF              ;setup of interruption from trailing edges

#struct _TTS_IB7303              ;module initialization table structure
        _TTS_Head       Head,    ;table heading
        USINT[2]        EDI,     ;activation of figures of eight of the input
        USINT[2]        EINT,    ;interrupt flag activation
        USINT           FLT,     ;filtering setup
        USINT           EDG,     ;short pulse detection
        _TTS_MINTRTF[2] MINTRTF  ;interruption setup from edges
```

Example of declaration of initialization table :

```
#table _TTS_IB7303 _r0_p3_Table = 7303,$01,$00,  ;table heading
                                  $80,$80,       ;activation of figures of
                                                 ;eight of the input
                                  $80,$80,       ;interruption flags
                                  $00,           ;filtering
                                  $00,           ;short pulses
                                  $01,$02,$00,$00 ;interruption setup
```

Example of declaration of module :

```
#struct TModulE1                 ;module declaration structure
        USINT version,           ;description version
        USINT rack,              ;rack address
        USINT address,           ;module address in the rack
        UINT  LogAddress,        ;logic address
        UINT  LenInputs,         ;length of input data zone
        UINT  LenOutputs,        ;length of output data zone
        DINT  OffsetInputs,      ;position of input data zone
        DINT  OffsetOutputs,     ;position of output data zone
        UINT  InitTable          ;initialization table index

#module TModulE1 1, 0, 3, 0, 4, 0, __offset(r0_p3_DI), 0,
 __indx (_r0_p3_Table)
```

The meanings of the items of the initialization table:

ModulID - module type identification code, here 7303

STAT0,STAT1 - data exchange status

STAT0

0	0	0	0	0	0	0	INT
.7	.6	.5	.4	.3	.2	.1	.0

STAT1

0	0	0	0	0	0	0	0
.7	.6	.5	.4	.3	.2	.1	.0

INT - interrupt from module
= 1 - the module can initiate interrupt
= 0 - the module cannot initiate interrupt

EDI - activation of operation of the figure of eight of digital inputs
= $80 - the figure of eight of inputs will be operated
= $00 - the figure of eight of inputs will not be operated

EINT - activation of transmission of flags of interrupt of the figure of eight of digital inputs
= $80 - the figure of eight of flags of interrupt will be transmitted
= $00 - the figure of eight of flags of interrupt will not be transmitted

FLT - filtering mode setup

FLT

0	0	0	0	AC3	AC2	AC1	AC0
.7	.6	.5	.4	.3	.2	.1	.0

ACn - filter of alternating inputs for a figure of eight n
= 1 - ON
= 0 - OFF

EDG - short pulse detection

EDG

LP3	SP3	LP2	SP2	LP1	SP1	LP0	SP0
.7	.6	.5	.4	.3	.2	.1	.0

SPn - short pulse detection for a figure of eight n
= 1 - enabled
= 0 - disabled

LPn - detected level of short pulse
= 1 - detect short pulses to the level of logic 1
= 0 - detect short pulses to the level of logic 0

MINTR - setup of interrupt from leading edges on digital inputs
MINTF - setup of interrupt from trailing edges on digital inputs

MINTRx

IR7	IR6	IR5	IR4	IR3	IR2	IR1	IR0
.7	.6	.5	.4	.3	.2	.1	.0

MINTFx

IF7	IF6	IF5	IF4	IF3	IF2	IF1	IF0
.7	.6	.5	.4	.3	.2	.1	.0

IRn - 0, IFn - 0 - interrupt from digital input DIn prohibited
IRn - 1, IFn - 0 - interrupt from leading edge of digital input DIn permitted
IRn - 0, IFn - 1 - interrupt from trailing edge of digital input DIn permitted
IRn - 1, IFn - 1 - interrupt from both edges of digital input DIn permitted

5.12 MODULE CONNECTION EXAMPLES

In preparation

6. DIGITAL INPUT MODULE IB-7305

The IB-7305 module is designed for scanning of up to 16 digital signals 230 V AC with a common pole, type 1. The module is fitted with a connector allowing the customer to make a choice of several variants selected and ordered separately by the customer (order numbers TXN 102 3x). The connectors are described in the documentation TXV 102 30 or in the Manual for designing TXV 001 08.01.

6.1 BASIC PARAMETERS

Product standard	ČSN EN 61131-2
Protection class of electrical object ČSN 33 0600	III
Connection	Removable connector, max. 2,5 mm2 conductor per terminal
Type of equipment	Built-in
Coverage (after installation into rack)	IP20 ČSN EN 60529
Dimensions	137 x 30 x 198 mm

6.2 OPERATIONAL CONDITIONS

Class of ambient influence – ČSN 33 2000-3	Normal
Operating temperatures range	0 °C to + 55 °C
Permissible temperatures during transport	-25 °C to +70 °C
Relative humidity	10 % to 95 % without condensation
Atmospheric pressure	min. 70 kPa (< 3000 m above see level)
Degree of pollution - ČSN EN 61131-2	2
Overvoltage category of installation - ČSN 33 0420-1	II
Working position	Vertical
Type of operation	Continuous
Electromagnetic compatibility	
Emissions - ČSN EN 55022*	Class A
Immunity	Table 16, ČSN EN 61131-2
Vibration resistance (sinusoidal vibrations) Fc according to ČSN EN 60068-2-6	10 Hz to 57 Hz amplitude 0,075 mm, 57 Hz to 150 Hz acceleration 1G

* This is a product of Class A. In indoor conditions (i.e. such conditions, where using of radio and TV sets can be supposed in a distance of 10 m from the mentioned equipment), the product can cause radio disturbances. It might be required in such cases that the user takes necessary measures to avoid this.

6.3 ELECTRICAL PARAMETERS

Number of inputs	16
Number of inputs in the group	8 (in two groups)
Galvanic isolation from internal circuits	Yes, groups and mutually
Diagnostics	Yes, signalization of energized input on module panel

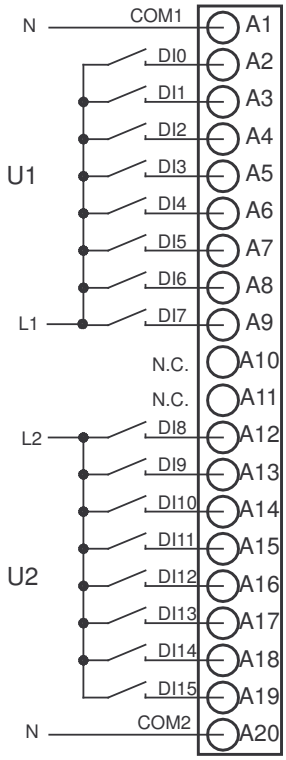
Common pole		Yes
Type of inputs		Type 1
Input voltage		
for log. 0 (UL)	Max.	40 V AC
for log. 1 (UH)	Min.	164 V AC
	Typ.	230 V AC
	Max.	253 V AC
Nominal frequency		50 / 60 Hz
Input current at log. 0	Max.	1 mA
Input current at log. 1	Typ.	5 mA
Delay from log. 0 to log. 1		10 ms
Delay from log. 1 to log. 0		10 ms
Insulation voltage among inputs and internal circuits		3750 V AC
Insulation voltage among groups of inputs among each other		2500 V AC
Module output loss	Max.	6 W
Module input power taken from system source	Max.	0,8 W

6.4 POWER SUPPLY

The module is fed from the power supply source, which is part of the TC700 system assembly.

6.5 CONNECTION

The module is fitted with a removable connector (order number of connector TXN 102 3x, according to customer's choice). The connection of the connector is illustrated on Fig. 6.1.



COMx common terminal of input circuits of the group
DIx input terminal of input x

Fig. 6.1 Connection of terminal board of module IB-7305

Detailed information on connection, proper installation procedure, examples of module connection and principles for increasing resistance and reliability can be found in the handbook for designing TXV 001 08.01.

6.6 OPERATION

6.6.1 Module HW configuration

The module is operated, set and diagnosed from the MOSAIC development environment. No setup is made on the module itself.

6.6.2 Putting in operation

After putting the module into the rack and switching power supply on, the module is fully ready for operation and does not require any other settings of its elements.

6.7 DIAGNOSTICS

The basic diagnostic system of the module is part of the standard module software. The diagnostic system becomes active after module power supply is on, and works independently from the user.

6.8 INDICATION

On the front panel, each input digital signal is assigned one green indication LED. If this LED is on, it indicates the presence of an input signal on the given terminal. Further, there is a green RUN LED on the front panel. If the RUN LED is on,, the module is in the HALT mode, if the RUN LED is flashing, the module is in the RUN mode.

Fig. 6.2 Indication panel of module IB-7305

6.9 MODULE SETUP

For a trouble-free module operation it is necessary to perform its SW setup within the frame of module declaration. The activation of the operation of digital inputs is carried out by figures of eight. Each figure of eight can be enabled or disabled to be operated. Further, for each figure of eight, detection of short pulses to log. 0 or to log. 1 can be set. Module setup is carried out within the MOSAIC development environment by means of the dialog given below.

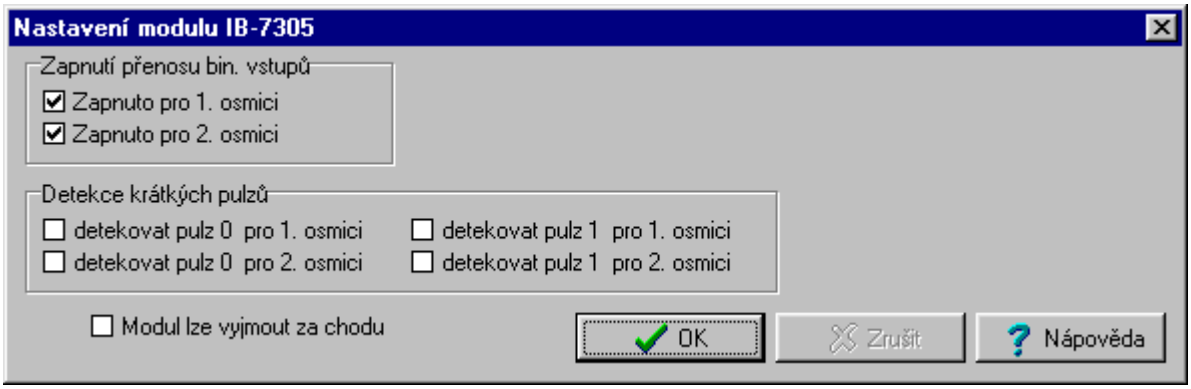


Fig. 6.3 Module SW setup

Switching on of the transmission of digital inputs

By enabling the option *Zapnuto pro n. osmici (ON for the n-th figure of eight)*, transmission of current states of the corresponding figure of eight of inputs into the PLC scratchpad is allowed.

If this option is not enabled for a figure of eight of the inputs, the relevant values are not transmitted and they do not appear in the PLC scratchpad. The firts figure of eight corresponds to the inputs DI0 ÷ DI7, the second figure of eight corresponds to the inputs DI8 ÷ DI15.

Short pulse detection

By enabling the option *Detekovat pulz 0 pro n. osmici* (Detect pulse 0 for the n-th figure of eight), the function of short pulse interception to log. 0 is activated. By enabling the option *Detekovat pulz 1 pro n. osmici* (Detect pulse 1 for the n-th figure of eight), the function of short pulse interception to log. 1 is activated.

If we have an input signal, which is mainly in the state of log. 1 and pulses to log. 0 appear on the signal, which are shorter than the longest possible cycle time of the PLC, then these pulses could be lost, since only the states of the inputs at the moment of the I/O scan of the central unit are standardly transmitted to the PLC. If we enable the detection of short pulses for the state of log. 0, then the input module reads the corresponding input much more frequently (approx. 11 ms), executes logical product of read values, which is then sent to the central unit as the resulting value of the input. If the value of log. 0 appears on the input during the cycle, it will be held in the module memory till the next data transmission to the central unit, even if the value of log. 1 is already on the input at the moment of data transmission. The same is valid analogically for the input signal, which is mainly in the state of log. 0 and short pulses to log. 1 appear on the signal. We enable the detection of short pulses for the state of log. 1 and the input module then executes the logical product of the read values of the input.

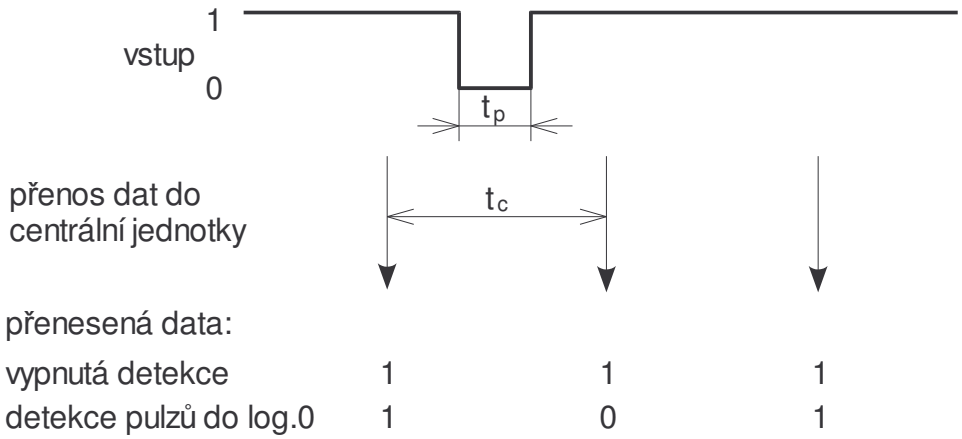


Fig. 6.4 Function of detection of short pulses to log. 0

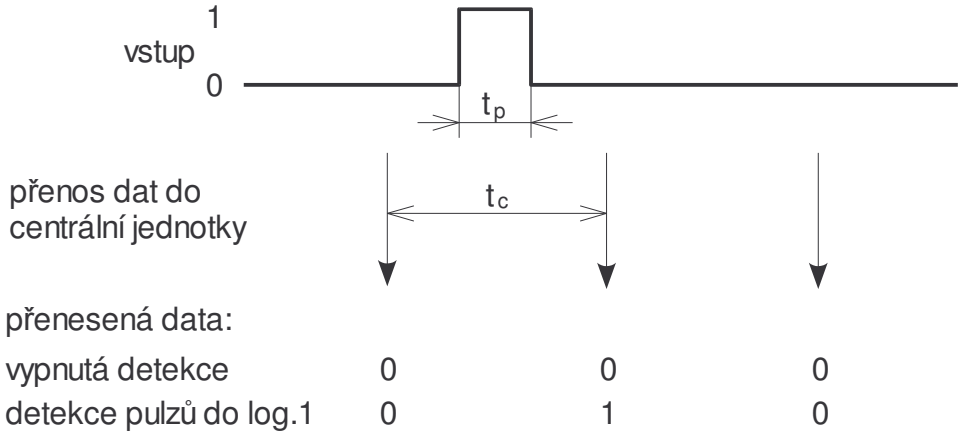
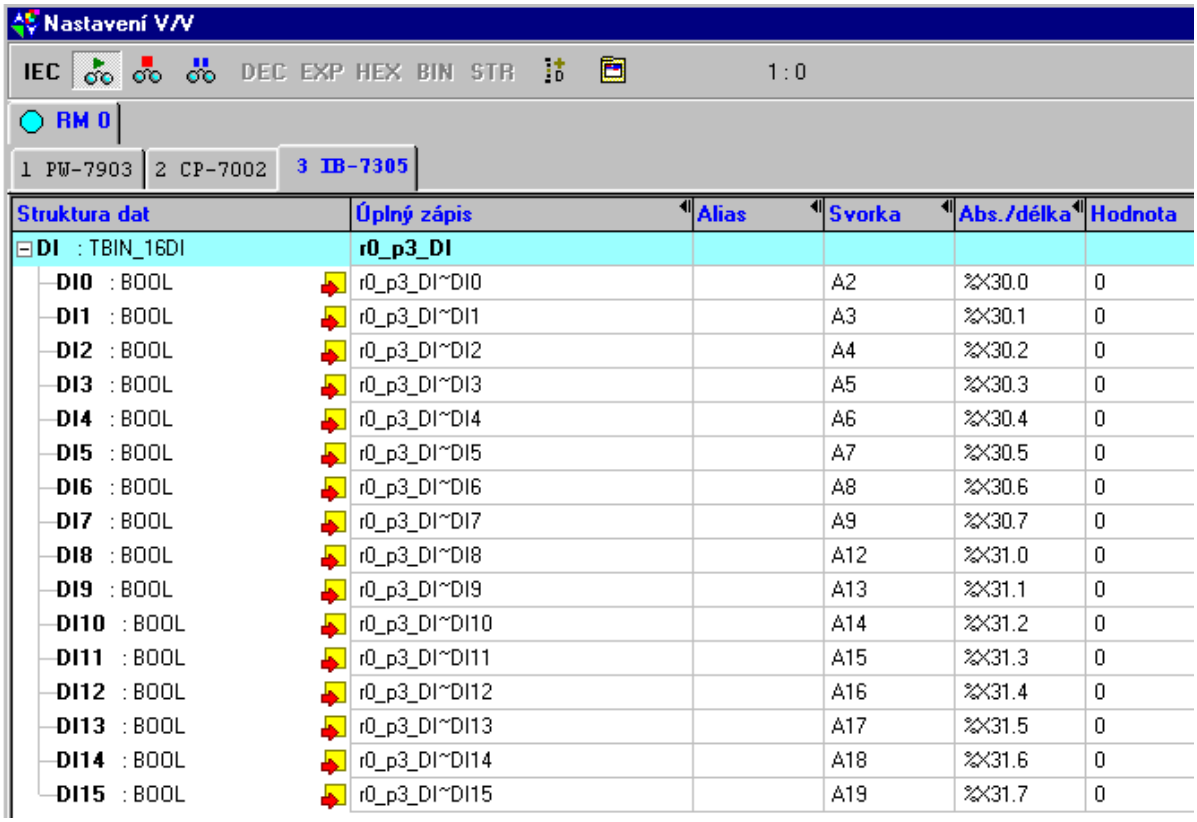


Fig. 6.5 Function of detection of short pulses to log. 1

For the a. m. figures, the following relation is valid: $t_c > t_p > 11ms$.

6.10 INPUT DATA STRUCTURE

The digital input module IB-7305 operates 16 input digital signals. In the data being transmitted, each input signal is represented by one variable of Boolean type. The structure items of the digital module have symbolic names assigned, beginning with the rack number and position number in the rack. In the column *Úplný zápis (Full Write)*, concrete symbolic name is specified for the given item. If you want to use the data in the user program, you will use either this symbolic name or you will write your symbolic name in the column *Alias*, that can be used later. Do not use absolute operands in any case, since they can change after a new compilation of the user program. The structure of passed data is obvious from the panel *Nastavení V/V (Setting V/V)* in the MOSAIC development environment (icon IO).



Struktura dat	Úplný zápis	Alias	Svorka	Abs./délka	Hodnota
DI : TBIN_16DI	r0_p3_DI				
DI0 : BOOL	r0_p3_DI~DI0		A2	%X30.0	0
DI1 : BOOL	r0_p3_DI~DI1		A3	%X30.1	0
DI2 : BOOL	r0_p3_DI~DI2		A4	%X30.2	0
DI3 : BOOL	r0_p3_DI~DI3		A5	%X30.3	0
DI4 : BOOL	r0_p3_DI~DI4		A6	%X30.4	0
DI5 : BOOL	r0_p3_DI~DI5		A7	%X30.5	0
DI6 : BOOL	r0_p3_DI~DI6		A8	%X30.6	0
DI7 : BOOL	r0_p3_DI~DI7		A9	%X30.7	0
DI8 : BOOL	r0_p3_DI~DI8		A12	%X31.0	0
DI9 : BOOL	r0_p3_DI~DI9		A13	%X31.1	0
DI10 : BOOL	r0_p3_DI~DI10		A14	%X31.2	0
DI11 : BOOL	r0_p3_DI~DI11		A15	%X31.3	0
DI12 : BOOL	r0_p3_DI~DI12		A16	%X31.4	0
DI13 : BOOL	r0_p3_DI~DI13		A17	%X31.5	0
DI14 : BOOL	r0_p3_DI~DI14		A18	%X31.6	0
DI15 : BOOL	r0_p3_DI~DI15		A19	%X31.7	0

Fig. 6.6 Data structure of digital module IB-7305

The module data structure is generated by the Mosaic program automatically (according to Setup V/V) to file HWconfig.ST.

```
TYPE
  TBIN_16DI : STRUCT
    DI0    : BOOL;
    DI1    : BOOL;
    DI2    : BOOL;
    DI3    : BOOL;
    DI4    : BOOL;
    DI5    : BOOL;
    DI6    : BOOL;
    DI7    : BOOL;
    DI8    : BOOL;
    DI9    : BOOL;
    DI10   : BOOL;
    DI11   : BOOL;
    DI12   : BOOL;
    DI13   : BOOL;
    DI14   : BOOL;
    DI15   : BOOL;
  END_STRUCT;
END_TYPE


VAR_GLOBAL
  r0_p3_DI              AT %X30   : TBIN_16DI;
END_VAR
```

Variable DI

The value passed in variable DIx corresponds to the state of the input signal of the corresponding digital input.

6.11 APPENDIX FOR ADVANCED USERS

The structures given below are typically automatically generated by the MOSAIC development environment (into file *.HWC) and it is not recommended to alter them. If the programmer does not use automatic configuration generation, the description below serves as a sample for manual module configuration.

6.11.1 Initialization data structure

The module requires an initialization table, this is represented in the declaration file of the MOSAIC development environment (*.HWC) by the following description:

```
#struct _TTS_Head                ;module heading structure
        UINT  ModulID,           ;module type identification code
        USINT Stat0,             ;status of data exchange
        USINT Stat1              ;status of data exchange

#struct _TTS_IB7305              ;module initialization table structure
        _TTS_Head Head,          ;table heading
        USINT[2]  EDI,           ;activation of figures of eight of the input
        USINT     FLT,           ;filtering activation - not used
        USINT     EDG            ;short pulse detection activation
```

Example of declaration of initialization table :

```
#table _TTS_IB7305 _r0_p3_Table = 7305,$00,$00,     ;table heading
                                      $80,$80,      ;activation of figures of
                                                    ;eight of the input
                                  $00,              ;filtering
                                  $00               ;short pulses
```

Example of declaration of module :

```
#struct TModulE1                 ;module declaration structure
        USINT version,           ;description version
        USINT rack,              ;rack address
        USINT address,           ;module address in the rack
        UINT  LogAddress,        ;logic address
        UINT  LenInputs,         ;length of input data zone
        UINT  LenOutputs,        ;length of output data zone
        DINT  OffsetInputs,      ;position of input data zone
        DINT  OffsetOutputs,     ;position of output data zone
        UINT  InitTable          ;initialization table index

#module TModulE1 1, 0, 3, 0, 2, 0, __offset(r0_p3_DI), 0,
 __indx (_r0_p3_Table)
```

The meanings of the items of the initialization table:

ModulID - module type identification code, here 7305

STAT0,STAT1 - data exchange status, here 0

EDI - activation of operation of the figure of eight of digital inputs
= $80 - the figure of eight of inputs will be operated
= $00 - the figure of eight of inputs will not be operated

FLT - for module IB-7305 not used

EDG - short pulse detection

EDG

0	0	0	0	LP1	SP1	LP0	SP0
.7	.6	.5	.4	.3	.2	.1	.0

SPn - short pulse detection for a figure of eight n
= 1 - enabled
= 0 - disabled

LPn - detected level of short pulse
= 1 - detect short pulses to the level of logic 1
= 0 - detect short pulses to the level of logic 0

6.12 MODULE CONNECTION EXAMPLES

In preparation

7. DIGITAL OUTPUT MODULE OS-7401

The OS-7401 module is designed for controlling of up to 16 loads 24 V DC / 2 A. The outputs are realized by means of semiconducting switches equipped with current and thermal protection. These protections are part of the module diagnostics. The module is fitted with a connector allowing the customer to make a choice of several variants selected and ordered separately by the customer (order numbers TXN 102 3x). The connectors are described in the documentation TXV 102 30 or in the Manual for designing TXV 001 08.01.

7.1 BASIC PARAMETERS

Product standard	ČSN EN 61131-2
Protection class of electrical object ČSN 33 0600	III
Connection	Removable connector, max. 2,5 mm2 conductor per terminal
Type of equipment	Built-in
Coverage (after installation into rack)	IP20 ČSN EN 60529
Dimensions	137 x 30 x 198 mm

7.2 OPERATIONAL CONDITIONS

Class of ambient influence – ČSN 33 2000-3	Normal
Operating temperatures range	0 °C to + 55 °C
Permissible temperatures during transport	-25 °C to +70 °C
Relative humidity	10 % to 95 % without condensation
Atmospheric pressure	min. 70 kPa (< 3000 m above see level)
Degree of pollution - ČSN EN 61131-2	2
Overvoltage category of installation - ČSN 33 0420-1	II
Working position	Vertical
Type of operation	Continuous
Electromagnetic compatibility	
Emissions - ČSN EN 55022*	Class A
Immunity	Table 16, ČSN EN 61131-2
Vibration resistance (sinusoidal vibrations) Fc according to ČSN EN 60068-2-6	10 Hz to 57 Hz amplitude 0,075 mm, 57 Hz to 150 Hz acceleration 1G

* This is a product of Class A. In indoor conditions (i.e. such conditions, where using of radio and TV sets can be supposed in a distance of 10 m from the mentioned equipment), the product can cause radio disturbances. It might be required in such cases that the user takes necessary measures to avoid this.

7.3 ELECTRICAL PARAMETERS

Number of outputs		16
Number of outputs in the group		16
Galvanic isolation from internal circuits		Yes
Diagnostics		Yes, signalization of closed output on the module panel, signalization of output protection equipment in module status
Common pole		Yes
Type of outputs		Semocunducting switch, protected output
Switching voltage	Max.	30 V DC
	Typ.	24 V DC
	Min.	9,6 V DC
Switching current	Max.	1 A (2 A) [1]
	Min.	mA
Common pole current	Max.	10 A [2]
Leakage current (log. 0)	Max.	300 μA
Switch on period of output	Typ.	80 μs
Switch off period of output	Typ.	80 μs
Limit values for switching load:		
- for resistance load	Max.	2 A at 24 V DC [1]
- for inductive load DC13	Max.	2 A at 24 V DC [1]
Voltage drop at max. load on closed output	Max.	0,15 V
Switching rate without load	Max.	switchings / min
Switching rate with nominal load	Max.	switchings / min
Polarity inversion protection [3]		Yes
Short-circuit protection		Internal
- limitation of initial peak current	Typ.	7,5 A
- disconnecting period of initial peak current	Typ.	4 ms
- limitation of short-circuit current	Typ.	6,5 A
Overload protection		Yes
- current limitation	Typ.	6,5 A
Inductive load treatment		External RC member, varistor, diode
External supply voltage of module output circuits		24 V DC
Max. consumption from external source (module internal circuits)		350 mA
Insulation voltage among inputs and internal circuits		500 V DC
Insulation voltage among groups of inputs among each other		500 V DC
Module output loss	Max.	10 W
Module input power taken from system source	Max.	0,8 W

[1] Maximum added-up current of four outputs (DO0÷3, DO4÷7, DO8÷11, DO12÷15) is 5A. If the added-up current of the four corresponding outputs has a higher value, limitation to the specified value takes place.

[2] Valid for each terminal UDO1 on the module individually. For full utilization of max. switched currents it is necessary to interconnect the UDO1 terminals.

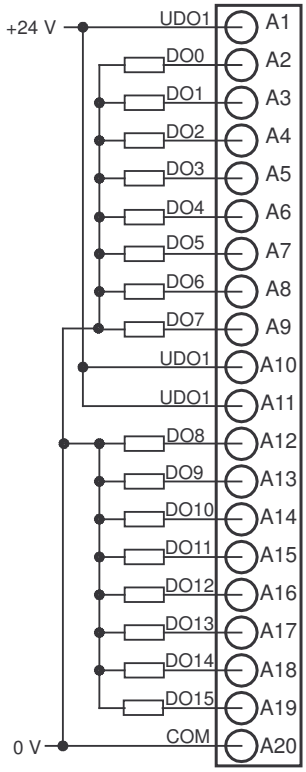
[3] The circuit will be put in inactive state, the loads will be closed and the current will flow through the protection diode of the circuit.

7.4 POWER SUPPLY

The module is fed from the power supply source, which is part of the TC700 system assembly.

7.5 CONNECTION

The module is fitted with a connector (order number of connector TXN 102 3x, according to customer's choice). The connection of the connector is illustrated on Fig. 7.1.



UDO1	common terminal of output circuits and internal circuits of the module (+ 24 V DC)
COM	terminal for feeding of internal circuits of the module (0 V)
DOx	output terminal of output x

Fig. 7.1 Connection of terminal board of module OS-7401

Detailed information on connection, proper installation procedure, examples of module connection and principles for increasing resistance and reliability can be found in the handbook for designing TXV 001 08.01.

7.6 OPERATION

7.6.1 Module HW configuration

The module is operated, set and diagnosed from the MOSAIC development environment. No setup is made on the module itself.

7.6.2 Putting in operation

After putting the module into the rack and switching power supply on, the module is fully ready for operation and does not require any other settings of its elements.

7.7 DIAGNOSTICS

The basic diagnostic system of the module is part of the standard module software. The diagnostic system becomes active after module power supply is on, and works independently from the user.

7.8 INDICATION

On the front panel of the module, one green indication LED is assigned to each output digital signal. Further, there is a green RUN LED on the front panel. If the LED is on, the module is in the HALT mode, if the RUN LED is flashing, the module is in the RUN mode. Additionally, there is a yellow BLK LED on the front panel and when this is on, blocking of digital outputs is indicated.

Fig. 7.2 Indication panel of module OS-7401

7.9 MODULE SETUP

For a trouble-free module operation it is necessary to perform its SW setup within the frame of module declaration. The activation of the operation of digital outputs is carried out by figures of eight. Each figure of eight can be enabled or disabled individually. Module setup is carried out within the MOSAIC development environment by means of the dialog given below.

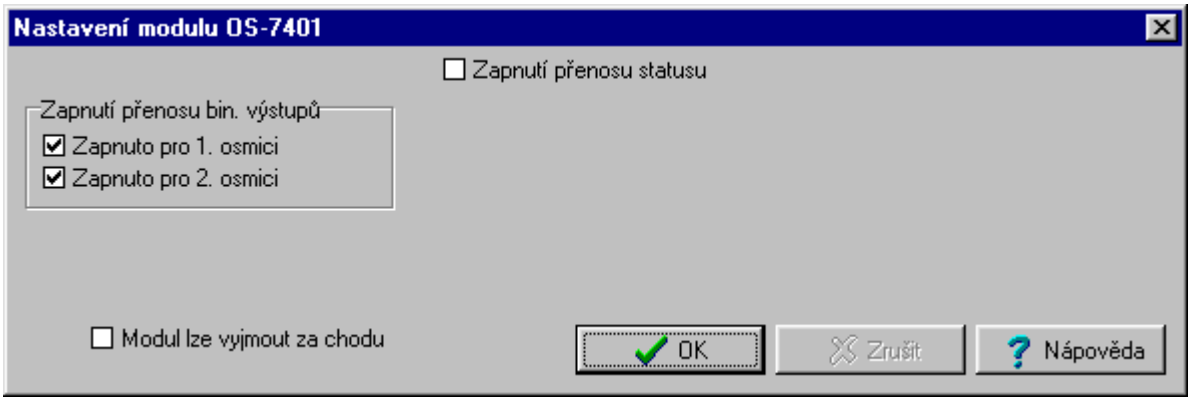


Fig. 7.3 Module SW setup

Switching on of transmission of digital outputs

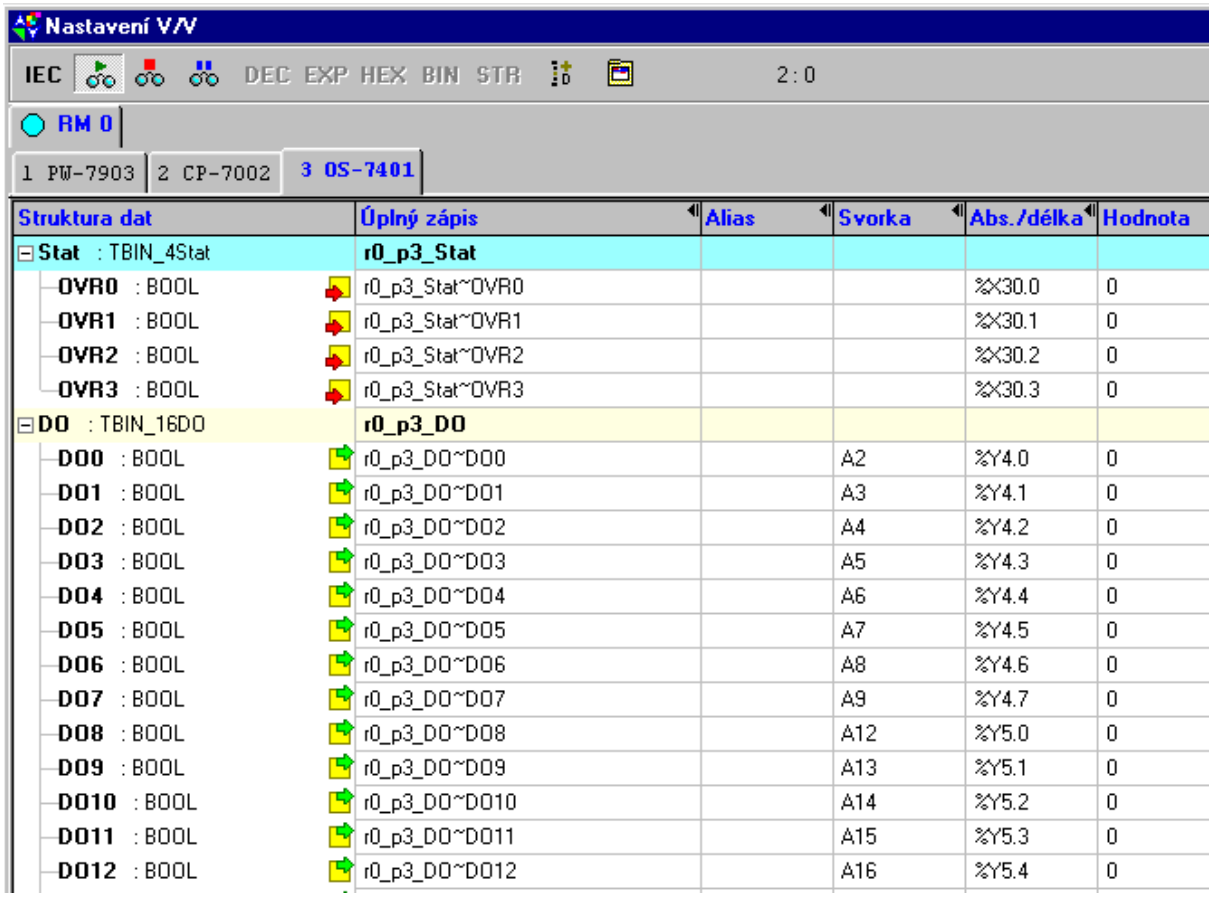
By enabling the option *Zapnuto pro n. osmici* (ON for the n-th figure of eight), transmission of current states of the corresponding figure of eight of outputs from the PLC scratchpad to the module is allowed. If this option is not enabled for a figure of eight of outputs, the relevant values will not be transmitted. The first figure of eight corresponds to the outputs DO0 ÷ DO7, the second figure of eight corresponds to the outputs DO8 ÷ DO15.

Switching on of transmission of status

By enabling of this option, we allow the transmission of the status byte of the module to the PLC scratchpad. The status contains information on overload of the digital outputs. If this option is not enabled, the status is not transmitted and it does not appear in the PLC scratchpad. The overload is indicated in the status for groups of digital outputs by 4.

7.10 TRANSMITTED DATA STRUCTURE

The digital output module OS-7401 operates 16 output digital signals. In the data being transmitted, each output signal is represented by one variable of Boolean type. Further, the periphery provides a status byte with the information on overload of digital outputs (by figures of four). The structure items of the digital module have symbolic names assigned, beginning with the rack number and position number in the rack. In the column *Úplný zápis (Full Write)*, concrete symbolic name is specified for the given item. If you want to use the data in the user program, you will use either this symbolic name or you will write your symbolic name in the column *Alias*, that can be used later. Do not use absolute operands in any case, since they can change after a new compilation of the user program. The structure of passed data is obvious from the panel *Nastavení V/V (Setting V/V)* in the MOSAIC development environment (icon 10).



Struktura dat	Úplný zápis	Alias	Svorka	Abs./délka	Hodnota
Stat : TBIN_4Stat	**r0_p3_Stat**				
OVR0 : BOOL	r0_p3_Stat~OVR0			%X30.0	0
OVR1 : BOOL	r0_p3_Stat~OVR1			%X30.1	0
OVR2 : BOOL	r0_p3_Stat~OVR2			%X30.2	0
OVR3 : BOOL	r0_p3_Stat~OVR3			%X30.3	0
DO : TBIN_16DO	**r0_p3_DO**				
DO0 : BOOL	r0_p3_DO~DO0		A2	%Y4.0	0
DO1 : BOOL	r0_p3_DO~DO1		A3	%Y4.1	0
DO2 : BOOL	r0_p3_DO~DO2		A4	%Y4.2	0
DO3 : BOOL	r0_p3_DO~DO3		A5	%Y4.3	0
DO4 : BOOL	r0_p3_DO~DO4		A6	%Y4.4	0
DO5 : BOOL	r0_p3_DO~DO5		A7	%Y4.5	0
DO6 : BOOL	r0_p3_DO~DO6		A8	%Y4.6	0
DO7 : BOOL	r0_p3_DO~DO7		A9	%Y4.7	0
DO8 : BOOL	r0_p3_DO~DO8		A12	%Y5.0	0
DO9 : BOOL	r0_p3_DO~DO9		A13	%Y5.1	0
DO10 : BOOL	r0_p3_DO~DO10		A14	%Y5.2	0
DO11 : BOOL	r0_p3_DO~DO11		A15	%Y5.3	0
DO12 : BOOL	r0_p3_DO~DO12		A16	%Y5.4	0

Fig. 7.4 Data structure of digital module OS-7401

The module data structure is generated by the Mosaic program automatically (according to Setup V/V) to file HWconfig.ST.

```
TYPE
  TBIN_16DO : STRUCT
    DO0   : BOOL;
    DO1   : BOOL;
    DO2   : BOOL;
    DO3   : BOOL;
    DO4   : BOOL;
    DO5   : BOOL;
    DO6   : BOOL;
    DO7   : BOOL;
    DO8   : BOOL;
    DO9   : BOOL;
    DO10   : BOOL;
    DO11   : BOOL;
    DO12   : BOOL;
    DO13   : BOOL;
    DO14   : BOOL;
    DO15   : BOOL;
  END_STRUCT;

  TBIN_4Stat : STRUCT
    OVR0 : BOOL;
    OVR1 : BOOL;
    OVR2 : BOOL;
    OVR3 : BOOL;
  END_STRUCT;
```

```
END_TYPE


VAR_GLOBAL
  r0_p3_Stat            AT %X30   : TBIN_4Stat;
  r0_p3_DO              AT %Y4    : TBIN_16DO;
END_VAR
```

Variable DO

The value passed in variable DOx corresponds to the state of the output signal of the corresponding digital output.

Variable STAT

In variable STAT, the module provides information on overload of the digital outputs. The overload is diagnosed for 4 groups by 4 outputs.

STAT

0	0	0	0	OVR3	OVR2	OVR1	OVR0
.7	.6	.5	.4	.3	.2	.1	.0

OVR0 - flag of overload for the group of digital outputs DO0 ÷ DO3
OVR1 - flag of overload for the group of digital outputs DO4 ÷ DO7
OVR2 - flag of overload for the group of digital outputs DO8 ÷ DO11
OVR3 - flag of overload for the group of digital outputs DO12 ÷ DO15
= 1 - one or more outputs are overloaded
= 0 - no output of the group is overloaded

7.11 APPENDIX FOR ADVANCED USERS

The structures given below are typically automatically generated by the MOSAIC development environment (into file *.HWC) and it is not recommended to alter them. If the programmer does not use automatic configuration generation, the description below serves as a sample for manual module configuration.

7.11.1 Initialization data structure

The module requires an initialization table, this is represented in the declaration file of the MOSAIC development environment (*.HWC) by the following description:

```
#struct _TTS_Head                ;module heading structure
        UINT  ModulID,           ;module type identification code
        USINT Stat0,             ;status of data exchange
        USINT Stat1              ;status of data exchange

#struct _TTS_OS7401              ;module initialization table structure
        _TTS_Head  Head,         ;heading
        USINT      ESO,          ;status activation
        USINT[2]   EDO           ;activation of figures of eight of outputs
```

Example of declaration of initialization table :

```
#table _TTS_OS7401 _r0_p3_Table = 7401,$00,$00,   ;table heading
                                  $80,            ;status activation
                                  $80,$80         ;activation of figures of
                                                  ;eight of outputs
```

Example of declaration of module :

```
#struct TModulE1                  ;module declaration structure
        USINT version,            ;description version
        USINT rack,               ;rack address
        USINT address,            ;module address in the rack
        UINT  LogAddress,         ;logic address
        UINT  LenInputs,          ;length of input data zone
        UINT  LenOutputs,         ;length of output data zone
        DINT  OffsetInputs,       ;position of input data zone
        DINT  OffsetOutputs,      ;position of output data zone
        UINT  InitTable           ;initialization table index

#module TModulE1 1, 0, 3, 0, 1, 2, __offset(r0_p3_Stat), __offset(r0_p3_DO),
__indx (_r0_p3_Table)
```

The meanings of the items of the initialization table:

ModulID - module type identification code, here 7401

STAT0,STAT1 - data exchange status, here 0

ESO - activation of transmission of status byte of module
= $80 - status will be transmitted
= $00 - status will not be transmitted

EDO - activation of operation of the figure of eight of digital outputs
= $80 - the figure of eight of outputs will be operated
= $00 - the figure of eight of outputs will not be operated

7.12 MODULE CONNECTION EXAMPLES

Example 1 The following actuators are connected to the module:
- 4 external relays

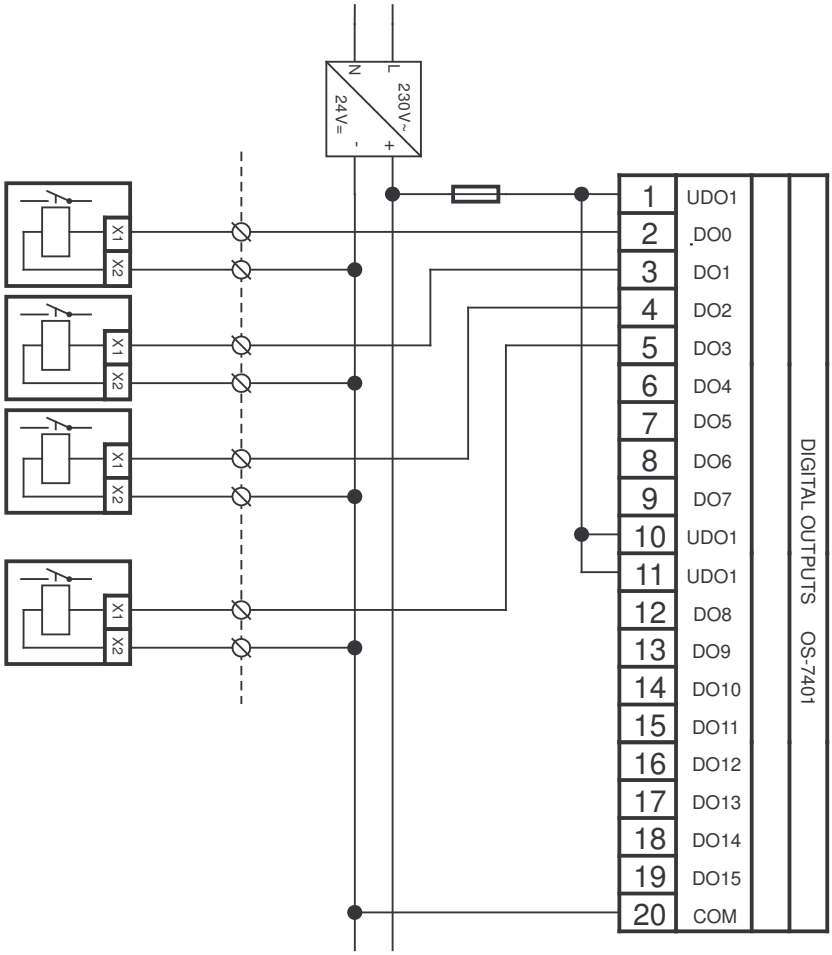


Fig. 7.5 Connector of module OS-7401 (connection example)

Notes:

1. *Signal UDO1is led to more terminals due to current load (its distribution). To reach the full performance of the module, it is necessary to connect all terminals!*
2. *Signal COM (terminal 20) is necessary for the function of the output circuits (semiconducting switches) of the module*

8. DIGITAL OUTPUT MODULE OS-7402

The OS-7402 module is designed for controlling of up to 32 loads 24 V DC / 0,5 A. The outputs are realized by semiconducting switches equipped with current and thermal protection. These protections are part of the module diagnostics. The module is fitted with two connectors (set TXN 102 40, they are ordered separately) with screwless terminals, always 16 outputs are terminated on them. The module is equipped with intelligent output circuits that require connecting of external supply voltage of 24 V DC.

8.1 BASIC PARAMETERS

Product standard	ČSN EN 61131-2
Protection class of electrical object ČSN 33 0600	III
Connection	Removable connectors, max. 1,0 mm^2 conductor per terminal
Type of equipment	Built-in
Coverage (after installation into rack)	IP20 ČSN EN 60529
Dimensions	137 x 30 x 198 mm

8.2 OPERATIONAL CONDITIONS

Class of ambient influence – ČSN 33 2000-3	Normal
Operating temperatures range	0 °C to + 55 °C
Permissible temperatures during transport	-25 °C to +70 °C
Relative humidity	10 % to 95 % without condensation
Atmospheric pressure	min. 70 kPa (< 3000 m above see level)
Degree of pollution - ČSN EN 61131-2	2
Overvoltage category of installation - ČSN 33 0420-1	II
Working position	Vertical
Type of operation	Continuous
Electromagnetic compatibility	
Emissions - ČSN EN 55022*	Class A
Immunity	Table 16, ČSN EN 61131-2
Vibration resistance (sinusoidal vibrations) Fc according to ČSN EN 60068-2-6	10 Hz to 57 Hz amplitude 0,075 mm, 57 Hz to 150 Hz acceleration 1G

* This is a product of Class A. In indoor conditions (i.e. such conditions, where using of radio and TV sets can be supposed in a distance of 10 m from the mentioned equipment), the product can cause radio disturbances. It might be required in such cases that the user takes necessary measures to avoid this.

8.3 ELECTRICAL PARAMETERS

Number of outputs		32
Number of outputs in the group		32
Galvanic isolation from internal circuits		Yes
Diagnostics		Yes, signalization of closed contact on module panel
Common pole		Yes
Type of outputs		Semiconducting switch, protected output
Switching voltage	Max.	30 V DC
	Typ.	24 V DC
	Min.	11 V DC
Switching current	Max.	0,5 A
Common pole current	Max.	16 A [1)]
Leakage current (log. 0)	Max.	300 μA
Switch on period of output	Typ.	400 μs
Switch off period of output	Typ.	400 μs
Limit values for switching load:		
- for resistance load	Max.	0,5 A at 24 V DC
- for inductive load DC13	Max.	0,5 A at 24 V DC
Voltage drop at max. load on closed output	Max.	0,18 V
Switching rate without load	Max.	1200 switchings / min
Switching rate with nominal load	Max.	300 switchings / min
Polarity inversion protection [2)]		Yes
Short-circuit protection		Internal
- limitation of initial peak current	Typ.	1,4 A
- limitation of short-circuit current	Typ.	1,1 A
Overload protection		Yes, thermal
- current limitation		output OFF
Inductive load treatment		external RC member, varistor, diode (DC)
External supply voltage of module output circuits		24 V DC
Max. consumption from external source (internal circuits)		350 mA
Insulation voltage among inputs and internal circuits		500 V DC
Module output loss	Max.	10 W
Module input power taken from system source	Max.	1,75 W

1) Valid in case of mutual interconnection of all UDO1 terminals on the module.

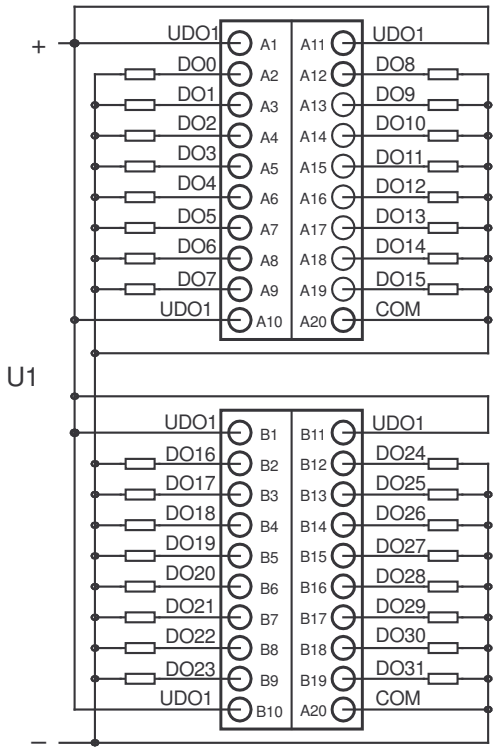
2) The circuit will be put in inactive state, the loads will be closed and the current will flow through the protection diode of the circuit.

8.4 POWER SUPPLY

The module is fed from the power supply source, which is part of the TC700 system assembly.

8.5 CONNECTION

The module is fitted with two identical screwless connectors (order number of connector set TXN 102 40). The connection of connectors is illustrated on Fig. 8.1.



UDO1	common terminal of output circuits of the module (+ 24 V DC)
COM	terminal for feeding of output circuits
DOx	output terminal of output x

Fig. 8.1 Connection of terminal board of module OS-7402

Detailed information on connection, proper installation procedure, examples of module connection and principles for increasing resistance and reliability can be found in the handbook for designing TXV 001 08.01.

8.6 OPERATION

8.6.1 Module HW configuration

The module is operated, set and diagnosed from the MOSAIC development environment. No setup is made on the module itself.

8.6.2 Putting in operation

After putting the module into the rack and switching power supply on, the module is fully ready for operation and does not require any other settings of its elements.

8.7 DIAGNOSTICS

The basic diagnostic system of the module is part of the standard module software. The diagnostic system becomes active after module power supply is on, and works independently from the user.

8.8 INDICATION

On the front panel of the module, one green indication LED is assigned to each output digital signal. Further, there is a green RUN LED on the front panel. If the LED is on, the module is in the HALT mode, if the RUN LED is flashing, the module is in the RUN mode. Additionally, there is a yellow BLK LED on the front panel and when this is on, blocking of digital outputs is indicated.

Fig. 8.2 Indication panel of module OS-7402

8.9 MODULE SETUP

For a trouble-free module operation it is necessary to perform its SW setup within the frame of module declaration. The activation of the operation of digital outputs is carried out by figures of eight. Each figure of eight can be enabled or disabled individually. Module setup is carried out within the MOSAIC development environment by means of the dialog given below.

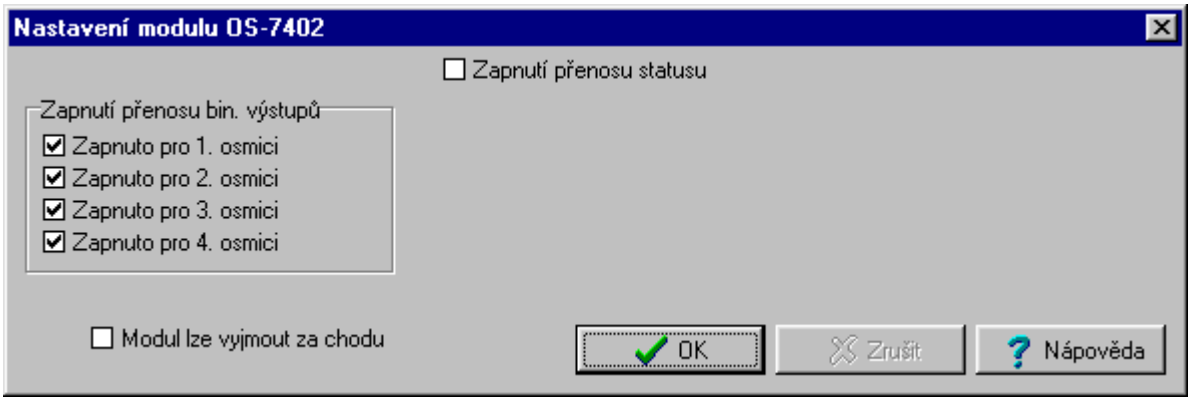


Fig. 8.3 Module SW setup

Switching on of transmission of digital outputs

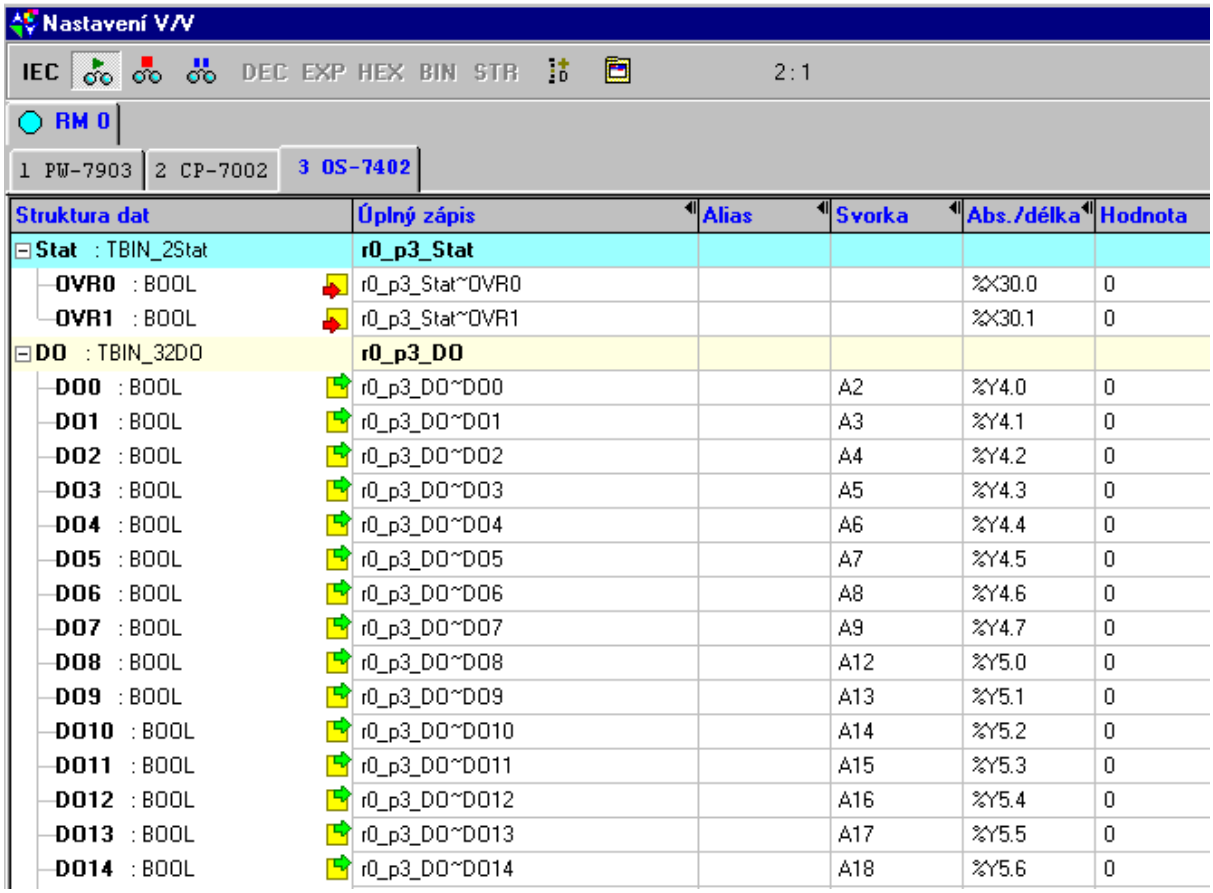
By enabling the option *Zapnuto pro n. osmici* (ON for the n-th figure of eight), transmission of current states of the corresponding figure of eight of outputs from the PLC scratchpad to the module is allowed. If this option is not enabled for a figure of eight of outputs, the relevant values will not be transmitted. The first figure of eight corresponds to the outputs DO0 ÷ DO7, the second figure of eight corresponds to the outputs DO8 ÷ DO15, the third figure of eight corresponds to the outputs DO16 ÷ DO23 and the fourth figure of eight corresponds to the outputs DO24 ÷ DO31.

Switching on of transmission of status

By enabling of this option, we allow the transmission of the status byte of the module to the PLC scratchpad. The status contains information on overload of the digital outputs. If this option is not enabled, the status is not transmitted and it does not appear in the PLC scratchpad. The overload is indicated in the status for groups of digital outputs by 16.

8.10 TRANSMITTED DATA STRUCTURE

The digital output module OS-7402 operates 16 output digital signals. In the data being transmitted, each output signal is represented by one variable of Boolean type. Further, the periphery provides a status byte with the information on overload of digital outputs (by figures of sixteen). The structure items of the digital module have symbolic names assigned, beginning with the rack number and position number in the rack. In the column *Úplný zápis (Full Write)*, concrete symbolic name is specified for the given item. If you want to use the data in the user program, you will use either this symbolic name or you will write your symbolic name in the column *Alias*, that can be used later. Do not use absolute operands in any case, since they can change after a new compilation of the user program. The structure of passed data is obvious from the panel *Nastavení V/V (Setting V/V)* in the MOSAIC development environment (icon).



Struktura dat	Úplný zápis	Alias	Svorka	Abs./délka	Hodnota
Stat : TBIN_2Stat	r0_p3_Stat				
OVR0 : BOOL	r0_p3_Stat~OVR0			%X30.0	0
OVR1 : BOOL	r0_p3_Stat~OVR1			%X30.1	0
DO : TBIN_32DO	r0_p3_DO				
DO0 : BOOL	r0_p3_DO~DO0		A2	%Y4.0	0
DO1 : BOOL	r0_p3_DO~DO1		A3	%Y4.1	0
DO2 : BOOL	r0_p3_DO~DO2		A4	%Y4.2	0
DO3 : BOOL	r0_p3_DO~DO3		A5	%Y4.3	0
DO4 : BOOL	r0_p3_DO~DO4		A6	%Y4.4	0
DO5 : BOOL	r0_p3_DO~DO5		A7	%Y4.5	0
DO6 : BOOL	r0_p3_DO~DO6		A8	%Y4.6	0
DO7 : BOOL	r0_p3_DO~DO7		A9	%Y4.7	0
DO8 : BOOL	r0_p3_DO~DO8		A12	%Y5.0	0
DO9 : BOOL	r0_p3_DO~DO9		A13	%Y5.1	0
DO10 : BOOL	r0_p3_DO~DO10		A14	%Y5.2	0
DO11 : BOOL	r0_p3_DO~DO11		A15	%Y5.3	0
DO12 : BOOL	r0_p3_DO~DO12		A16	%Y5.4	0
DO13 : BOOL	r0_p3_DO~DO13		A17	%Y5.5	0
DO14 : BOOL	r0_p3_DO~DO14		A18	%Y5.6	0

Fig. 8.4 Data structure of digital module OS-7402

The module data structure is generated by the Mosaic program automatically (according to Setup V/V) to file HWconfig.ST.

```
TYPE
  TBIN_32DO : STRUCT
    DO0  : BOOL;
    DO1  : BOOL;
    DO2  : BOOL;
    DO3  : BOOL;
    DO4  : BOOL;
    DO5  : BOOL;
    DO6  : BOOL;
    DO7  : BOOL;
    DO8  : BOOL;
    DO9  : BOOL;
    DO10  : BOOL;
    DO11  : BOOL;
    DO12  : BOOL;
    DO13  : BOOL;
    DO14  : BOOL;
    DO15  : BOOL;
    DO16  : BOOL;
    DO17  : BOOL;
    DO18  : BOOL;
    DO19  : BOOL;
    DO20  : BOOL;
    DO21  : BOOL;
    DO22  : BOOL;
    DO23  : BOOL;
```

```
    DO24  : BOOL;
    DO25  : BOOL;
    DO26  : BOOL;
    DO27  : BOOL;
    DO28  : BOOL;
    DO29  : BOOL;
    DO30  : BOOL;
    DO31  : BOOL;
  END_STRUCT;

  TBIN_2Stat : STRUCT
    OVR0 : BOOL;
    OVR1 : BOOL;
  END_STRUCT;
END_TYPE


VAR_GLOBAL
  r0_p3_Stat            AT %X30   : TBIN_2Stat;
  r0_p3_DO              AT %Y4    : TBIN_32DO;
END_VAR
```

Variable DO

The value passed in variable DOx corresponds to the state of the output signal of the corresponding output.

Variable STAT

In variable STAT, the module provides information on overload of digital outputs. The overload is diagnosed for 2 groups by 16 outputs.

STAT

0	0	0	0	0	0	OVR1	OVR0
.7	.6	.5	.4	.3	.2	.1	.0

OVR0 - flag of overload for the group of digital outputs DO0 ÷ DO15
OVR1 - flag of overload for the group of digital outputs DO16 ÷ DO31
= 1 - one or more outputs are overloaded
= 0 - no output of the group is overloaded

8.11 APPENDIX FOR ADVANCED USERS

The structures given below are typically automatically generated by the MOSAIC development environment (into file *.HWC) and it is not recommended to alter them. If the programmer does not use automatic configuration generation, the description below serves as a sample for manual module configuration.

8.11.1 Initialization data structure

The module requires an initialization table, this is represented in the declaration file of the MOSAIC development environment (*.HWC) by the following description:

```
#struct _TTS_Head                ;module heading structure
        UINT  ModulID,           ;module type identification code
        USINT Stat0,             ;status of data exchange
        USINT Stat1              ;status of data exchange

#struct _TTS_OS7402              ;module initialization table structure
        _TTS_Head  Head,         ;heading
        USINT      ESO,          ;status activation
        USINT[4]   EDO           ;activation of figures of eight of outputs
```

Example of declaration of initialization table :

```
#table _TTS_OS7402 _r0_p3_Table = 7402,$00,$00,  ;table heading
                                  $80,           ;status activation
                                  $80,$80,$80,$80;activation of figures of
                                                 ;eight of outputs
```

Example of declaration of module :

```
#struct TModulE1                 ;module declaration structure
        USINT version,           ;description version
        USINT rack,              ;rack address
        USINT address,           ;module address in the rack
        UINT  LogAddress,        ;logic address
        UINT  LenInputs,         ;length of input data zone
        UINT  LenOutputs,        ;length of output data zone
        DINT  OffsetInputs,      ;position of input data zone
        DINT  OffsetOutputs,     ;position of output data zone
        UINT  InitTable          ;initialization table index

#module TModulE1 1, 0, 3, 0, 1, 4, __offset(r0_p3_Stat), __offset(r0_p3_DO),
__indx (_r0_p3_Table)
```

The meanings of the items of the initialization table:

ModulID - module type identification code, here 7402

STAT0,STAT1 - data exchange status, here 0

ESO - activation of transmission of status byte of module
= $80 - status will be transmitted
= $00 - status will not be transmitted

EDO - activation of operation of the figure of eight of digital outputs
= $80 - the figure of eight of outputs will be operated
= $00 - the figure of eight of outputs will not be operated

8.12 MODULE CONNECTION EXAMPLES

Example 1 The following actuators are connected to the module:

- 4 external relays

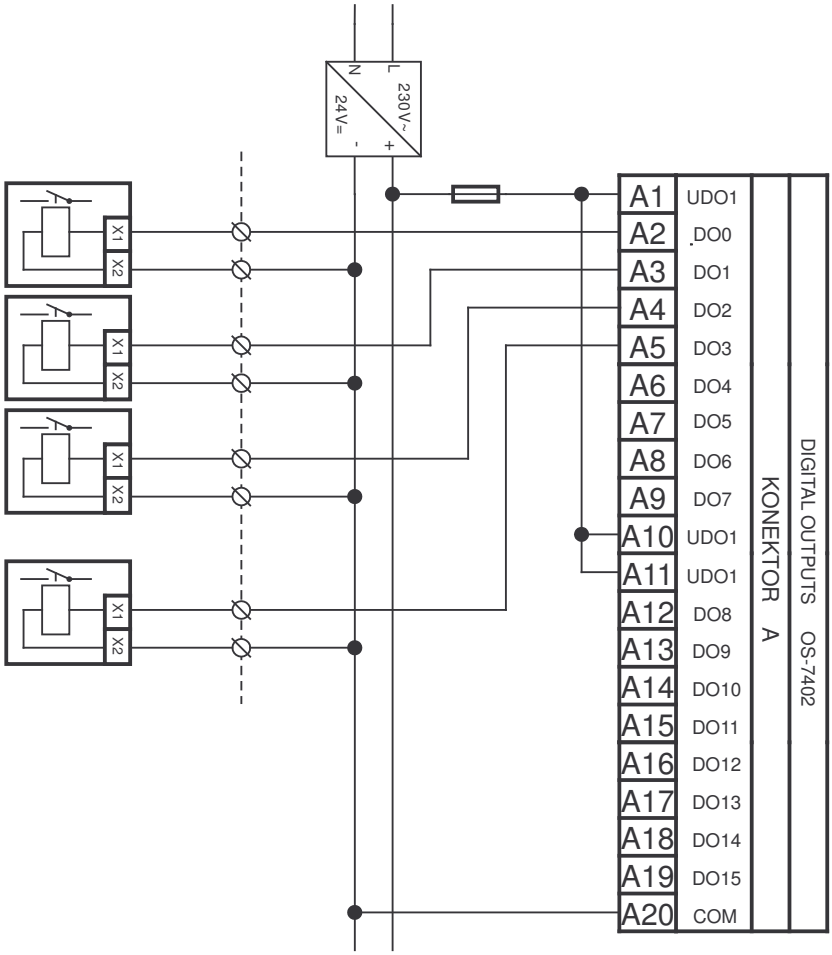


Fig. 8.5 Connector of module OS-7402 (connection example)

Notes:

1. *Signal UDO1is led to more terminals due to current load (its distribution). To reach the full performance of the module, it is necessary to connect all terminals!*
2. *Signal COM (terminal 20) is necessary for the function of the output circuits (semiconducting switches) of the module.*
3. *Also connector B is connected identically (outputs DO16 to DO31).*

9. DIGITAL OUTPUT MODULE OS-7405

The OS-7405 module is equipped with 16 outputs fitted with semiconducting relays (SSR) for switching of alternating signals of up to 230 V AC / 0,25 A. The module is fitted with a connector allowing the customer to make a choice of several variants selected and ordered separately by the customer (order numbers TXN 102 3x). The connectors are described in the documentation TXV 102 30 or in the Manual for designing TXV 001 08.01.

9.1 BASIC PARAMETERS

Product standard	ČSN EN 61131-2
Protection class of electrical object ČSN 33 0600	II
Connection	Removable connector, max. 2,5 mm2 conductor per terminal
Type of equipment	Built-in
Coverage (after installation into rack)	IP20 ČSN EN 60529
Dimensions	137 x 30 x 198 mm

9.2 OPERATIONAL CONDITIONS

Class of ambient influence – ČSN 33 2000-3	Normal
Operating temperatures range	0 °C to + 55 °C
Permissible temperatures during transport	-25 °C to +70 °C
Relative humidity	10 % to 95 % without condensation
Atmospheric pressure	Min. 70 kPa (< 3000 m above see level)
Degree of pollution - ČSN EN 61131-2	2
Overvoltage category of installation - ČSN 33 0420-1	II
Working position	Vertical
Type of operation	Continuous
Electromagnetic compatibility	
Emissions - ČSN EN 55022*	Class A
Immunity	Table 16, ČSN EN 61131-2
Vibration resistance (sinusoidal vibrations) Fc according to ČSN EN 60068-2-6	10 Hz to 57 Hz amplitude 0,075 mm, 57 Hz to 150 Hz acceleration 1G

* This is a product of Class A. In indoor conditions (i.e. such conditions, where using of radio and TV sets can be supposed in a distance of 10 m from the mentioned equipment), the product can cause radio disturbances. It might be required in such cases that the user takes necessary measures to avoid this.

9.3 ELECTRICAL PARAMETERS

Number of outputs	16
Number of outputs in the group	4 (in four groups)
Galvanic isolation from internal circuits	Yes, groups and mutually
Diagnostics	Yes, signalization of closed output on the module panel

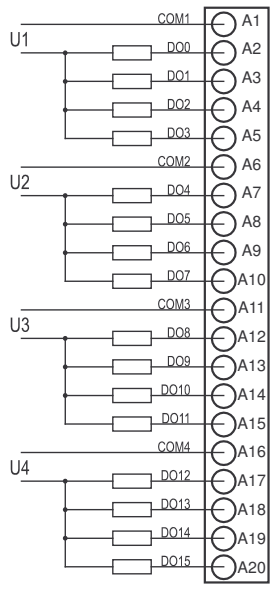
Common pole		Yes
Type of outputs		SSR, switching at zero, unprotected output
Type of contact		make contact
Switching voltage	Max.	250 V AC
	Min.	20 V AC
Switching current	Max.	0,25 A
	Min.	5 mA
Short time overload capacity of output	Max.	1 A
Common pole current	Max.	4 A
Switch on period of contact	Max.	10 ms
Switch off period of contact	Max.	10 ms
Limit values for switching load:		
- for resistance load	Max.	0,25 A at 230 V AC
- for inductive load AC15	Max.	0,25 A at 230 V AC
Switching rate without load	Max.	400 switchings / s
Switching rate with nominal load	Max.	100 switchings / s
Short-circuit protection		External
Inductive load treatment		External RC member, varistor
Insulation voltage among inputs and internal circuits		3750 V AC
Insulation voltage among groups of inputs among each other		1000 V AC
Module output loss	Max.	5 W
Module input power taken from system source	Max.	1,8 W

9.4 POWER SUPPLY

The module is fed from the power supply source, which is part of the TC700 system assembly.

9.5 CONNECTION

The module is fitted with a connector (order number of connector TXN 102 3x, according to customer's choice). The connection of the connector is illustrated on Fig. 9.1.



COMx	output group common pole
DOx	output terminal of output x

Fig. 9.1 Connection of terminal board of module OS-7405

Detailed information on connection, proper installation procedure, examples of module connection and principles for increasing resistance and reliability can be found in the handbook for designing TXV 001 08.01.

9.6 OPERATION

9.6.1 Module HW configuration

The module is operated, set and diagnosed from the MOSAIC development environment. No setup is made on the module itself.

9.6.2 Putting in operation

After putting the module into the rack and switching power supply on, the module is fully ready for operation and does not require any other settings of its elements.

9.7 DIAGNOSTICS

The basic diagnostic system of the module is part of the standard module software. The diagnostic system becomes active after module power supply is on, and works independently from the user.

9.8 INDICATION

On the front panel of the module, one green indication LED is assigned to each output digital signal. Further, there is a green RUN LED on the front panel. If the LED is on, the module is in the HALT mode, if the RUN LED is flashing, the module is in the RUN mode. Additionally, there

is a yellow BLK LED on the front panel and when this is on, blocking of digital outputs is indicated.

Fig. 9.2 Indication panel of module OS-7405

9.9 MODULE SETUP

For a trouble-free module operation it is necessary to perform its SW setup within the frame of module declaration. The activation of the operation of digital outputs is carried out by figures of eight. Each figure of eight can be enabled or disabled individually. Module setup is carried out within the MOSAIC development environment by means of the dialog given below.

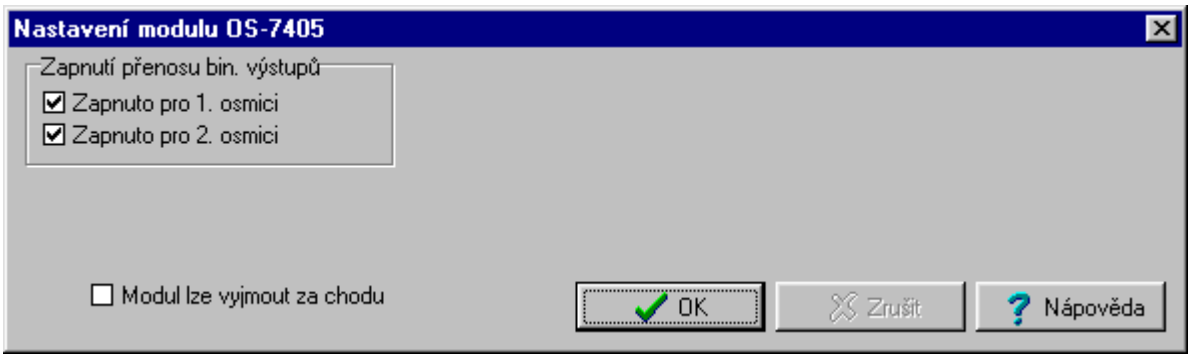


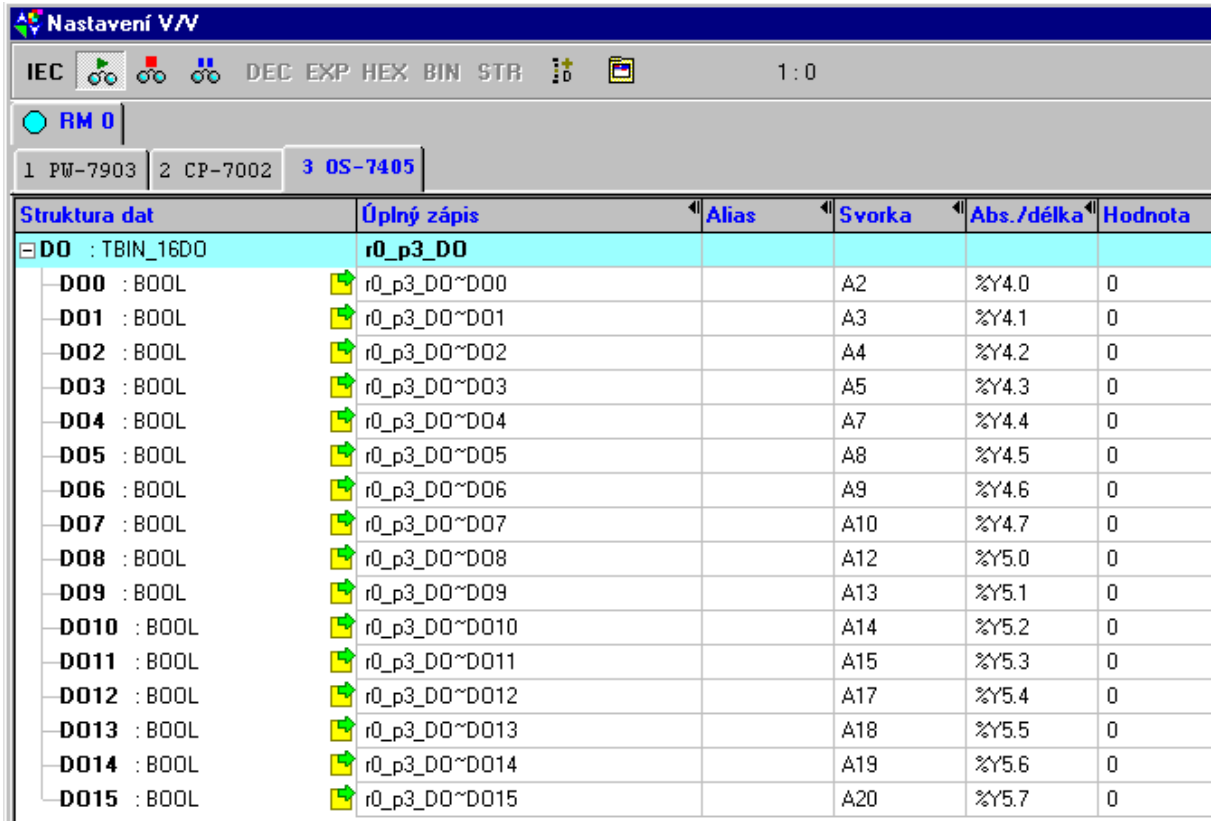
Fig. 9.3 Module SW setup

Switching on of transmission of digital outputs

By enabling the option *Zapnuto pro n. osmici* (ON for the n-th figure of eight), transmission of current states of the corresponding figure of eight of outputs from the PLC scratchpad to the module is allowed. If this option is not enabled for a figure of eight of outputs, the relevant values will not be transmitted. The first figure of eight corresponds to the outputs DO0 ÷ DO7, the second figure of eight corresponds to the outputs DO8 ÷ DO15.

9.10 TRANSMITTED DATA STRUCTURE

The digital output module OS-7405 operates 16 output digital signals. In the data being transmitted, each output signal is represented by one variable of Boolean type. The structure items of the digital module have symbolic names assigned, beginning with the rack number and position number in the rack. In the column *Úplný zápis (Full Write)*, concrete symbolic name is specified for the given item. If you want to use the data in the user program, you will use either this symbolic name or you will write your symbolic name in the column *Alias*, that can be used later. Do not use absolute operands in any case, since they can change after a new compilation of the user program. The structure of passed data is obvious from the panel *Nastavení V/V (Setting V/V)* in the MOSAIC development environment (icon IO).



Struktura dat	Úplný zápis	Alias	Svorka	Abs./délka	Hodnota
DO : TBIN_16DO	r0_p3_DO				
DO0 : BOOL	r0_p3_DO~DO0		A2	%Y4.0	0
DO1 : BOOL	r0_p3_DO~DO1		A3	%Y4.1	0
DO2 : BOOL	r0_p3_DO~DO2		A4	%Y4.2	0
DO3 : BOOL	r0_p3_DO~DO3		A5	%Y4.3	0
DO4 : BOOL	r0_p3_DO~DO4		A7	%Y4.4	0
DO5 : BOOL	r0_p3_DO~DO5		A8	%Y4.5	0
DO6 : BOOL	r0_p3_DO~DO6		A9	%Y4.6	0
DO7 : BOOL	r0_p3_DO~DO7		A10	%Y4.7	0
DO8 : BOOL	r0_p3_DO~DO8		A12	%Y5.0	0
DO9 : BOOL	r0_p3_DO~DO9		A13	%Y5.1	0
DO10 : BOOL	r0_p3_DO~DO10		A14	%Y5.2	0
DO11 : BOOL	r0_p3_DO~DO11		A15	%Y5.3	0
DO12 : BOOL	r0_p3_DO~DO12		A17	%Y5.4	0
DO13 : BOOL	r0_p3_DO~DO13		A18	%Y5.5	0
DO14 : BOOL	r0_p3_DO~DO14		A19	%Y5.6	0
DO15 : BOOL	r0_p3_DO~DO15		A20	%Y5.7	0

Fig. 9.4 Data structure of digital module OS-7405

The module data structure is generated by the Mosaic program automatically (according to Setup V/V) to file HWconfig.ST.

```
TYPE
  TBIN_16DO : STRUCT
    DO0  : BOOL;
    DO1  : BOOL;
    DO2  : BOOL;
    DO3  : BOOL;
    DO4  : BOOL;
    DO5  : BOOL;
    DO6  : BOOL;
    DO7  : BOOL;
```

```
    DO8   : BOOL;
    DO9   : BOOL;
    DO10   : BOOL;
    DO11   : BOOL;
    DO12   : BOOL;
    DO13   : BOOL;
    DO14   : BOOL;
    DO15   : BOOL;
  END_STRUCT;
END_TYPE


VAR_GLOBAL
  r0_p3_DO              AT %Y4    : TBIN_16DO;
END_VAR
```

Variable DO

The value passed in variable DOx corresponds to the state of the output signal of the corresponding output.

9.11 APPENDIX FOR ADVANCED USERS

The structures given below are typically automatically generated by the MOSAIC development environment (into file *.HWC) and it is not recommended to alter them. If the programmer does not use automatic configuration generation, the description below serves as a sample for manual module configuration.

9.11.1 Initialization data structure

The module requires an initialization table, this is represented in the declaration file of the MOSAIC development environment (*.HWC) by the following description:

```
#struct _TTS_Head                ;module heading structure
        UINT  ModulID,           ;module type identification code
        USINT Stat0,             ;status of data exchange
        USINT Stat1              ;status of data exchange

#struct _TTS_OS7405              ;module initialization table structure
        _TTS_Head  Head,         ;heading
        USINT[2]   EDO           ;activation of figures of eight of outputs
```

Example of declaration of initialization table :

```
#table _TTS_OS7405 _r0_p3_Table = 7405,$00,$00,   ;table heading
                                  $80,$80         ;activation of figures
                                                  ;of eight of outputs
```

Example of declaration of module :

```
#struct TModulE1                 ;module declaration structure
        USINT version,           ;description version
        USINT rack,              ;rack address
        USINT address,           ;module address in the rack
        UINT  LogAddress,        ;logic address
        UINT  LenInputs,         ;length of input data zone
```

```
        UINT  LenOutputs,        ;length of output data zone
        DINT  OffsetInputs,      ;position of input data zone
        DINT  OffsetOutputs,     ;position of output data zone
        UINT  InitTable          ;initialization table index

#module TModulE1 1, 0, 3, 0, 0, 2, 0, __offset(r0_p3_DO),
 __indx (_r0_p3_Table)
```

The meanings of the items of the initialization table:

ModulID - module type identification code, here 7405

STAT0,STAT1 - data exchange status, here 0

EDO - activation of operation of the figure of eight of digital outputs
= $80 - the figure of eight of outputs will be operated
= $00 - the figure of eight of outputs will not be operated

9.12 MODULE CONNECTION EXAMPLES

In preparation

10. DIGITAL OUTPUT MODULE OR-7451

The OR-7451 module is equipped with 16 relay outputs with make contacts. The module is fitted with a connector allowing the customer to make a choice of several variants selected and ordered separately by the customer (order numbers TXN 102 3x). The connectors are described in the documentation TXV 102 30 or in the Manual for designing TXV 001 08.01.

10.1 BASIC PARAMETERS

Product standard	ČSN EN 61131-2
Protection class of electrical object ČSN 33 0600	II
Connection	Removable connector, max. 2,5 mm2 conductor per terminal
Type of equipment	Built-in
Coverage (after installation into rack)	IP20 ČSN EN 60529
Dimensions	137 x 30 x 198 mm

10.2 OPERATIONAL CONDITIONS

Class of ambient influence – ČSN 33 2000-3	Normal
Operating temperatures range	0 °C to + 55 °C
Permissible temperatures during transport	-25 °C to +70 °C
Relative humidity	10 % to 95 % without condensation
Atmospheric pressure	Min. 70 kPa (< 3000 m above see level)
Degree of pollution - ČSN EN 61131-2	2
Overvoltage category of installation - ČSN 33 0420-1	II
Working position	Vertical
Type of operation	Continuous
Electromagnetic compatibility	
Emissions - ČSN EN 55022*	Class A
Immunity	Table 16, ČSN EN 61131-2
Vibration resistance (sinusoidal vibrations) Fc according to ČSN EN 60068-2-6	10 Hz to 57 Hz amplitude 0,075 mm, 57 Hz to 150 Hz acceleration 1G

* This is a product of Class A. In indoor conditions (i.e. such conditions, where using of radio and TV sets can be supposed in a distance of 10 m from the mentioned equipment), the product can cause radio disturbances. It might be required in such cases that the user takes necessary measures to avoid this.

10.3 ELECTRICAL PARAMETERS

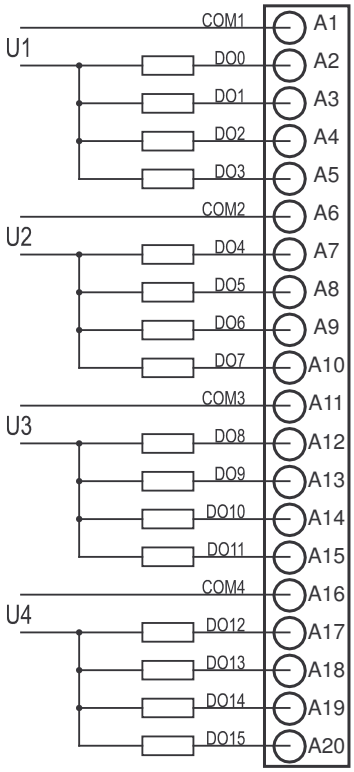
Number of outputs		16
Number of outputs in the group		4 (in four groups)
Galvanic isolation from internal circuits		Yes, groups and mutually
Diagnostics		Yes, signalization of closed contact on module panel
Common pole		Yes
Type of outputs		Electromechanical relay, unprotected output
Type of contact		Make contact
Switching voltage	Max.	250 V
	Min.	12 V
Switching current	Max.	3 A
	Min.	100 mA
Short time overload capacity of output	Max.	6 A
Common pole current	Max.	10 A
Switch on period of contact	Typ.	5 ms
Switch off period of contact	Typ.	6 ms
Contact bounce period	Typ.	1 ms
Limit values for switching load:		
- for resistance load	Max.	3 A at 30 V DC or 230 V AC
- for inductive load DC13	Max.	3 A at 30 V DC
- for inductive load AC15	Max.	3 A at 230 V AC
Switching rate without load	Max.	1200 switchings / min
Switching rate with nominal load	Max.	6 switchings / min
Mechanical lifetime	Min.	5 000 000 cycles
Electric lifetime at max. load:		
- for resistance load	Min.	400 000 cycles
- for inductive load DC13	Min.	7 000 cycles
- for inductive load AC15	Min.	100 000 cycles
Short-circuit protection		External
Inductive load treatment		External RC member, varistor, diode (DC)
Insulation voltage among inputs and internal circuits		3750 V AC
Insulation voltage among groups of inputs among each other		1000 V AC
Module output loss	Max.	3.8 W
Module input power taken from system source	Max.	3,8 W

10.4 POWER SUPPLY

The module is fed from the power supply source, which is part of the TC700 system assembly.

10.5 CONNECTION

The module is fitted with a connector (order number of connector TXN 102 3x, according to customer's choice). The connection of the connector is illustrated on Fig. 10.1.



COMx output group common pole
DOx output terminal of output x

Fig. 10.1 Connection of terminal board of module OR-7451

Detailed information on connection, proper installation procedure, examples of module connection and principles for increasing resistance and reliability can be found in the handbook for designing TXV 001 08.01.

10.6 OPERATION

10.6.1 Module HW configuration

The module is operated, set and diagnosed from the MOSAIC development environment. No setup is made on the module itself.

10.6.2 Putting in operation

After putting the module into the rack and switching power supply on, the module is fully ready for operation and does not require any other settings of its elements.

10.7 DIAGNOSTICS

The basic diagnostic system of the module is part of the standard module software. The diagnostic system becomes active after module power supply is on, and works independently from the user.

10.8 INDICATION

On the front panel of the module, one green indication LED is assigned to each output digital signal. Further, there is a green RUN LED on the front panel. If the LED is on, the module is in the HALT mode, if the RUN LED is flashing, the module is in the RUN mode. Additionally, there is a yellow BLK LED on the front panel and when this is on, blocking of digital outputs is indicated.

Fig. 10.2 Indication panel of module OR-7451

10.9 MODULE SETUP

For a trouble-free module operation it is necessary to perform its SW setup within the frame of module declaration. The activation of the operation of digital outputs is carried out by figures of eight. Each figure of eight can be enabled or disabled individually. Module setup is carried out within the MOSAIC development environment by means of the dialog given below.

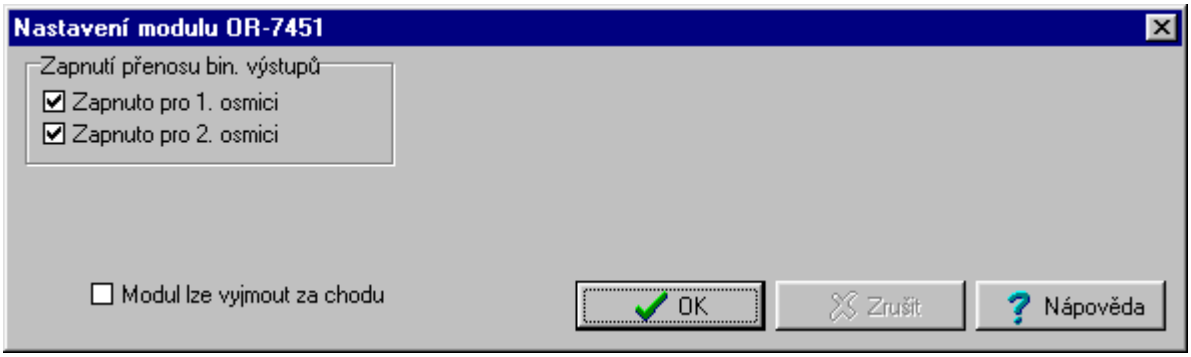


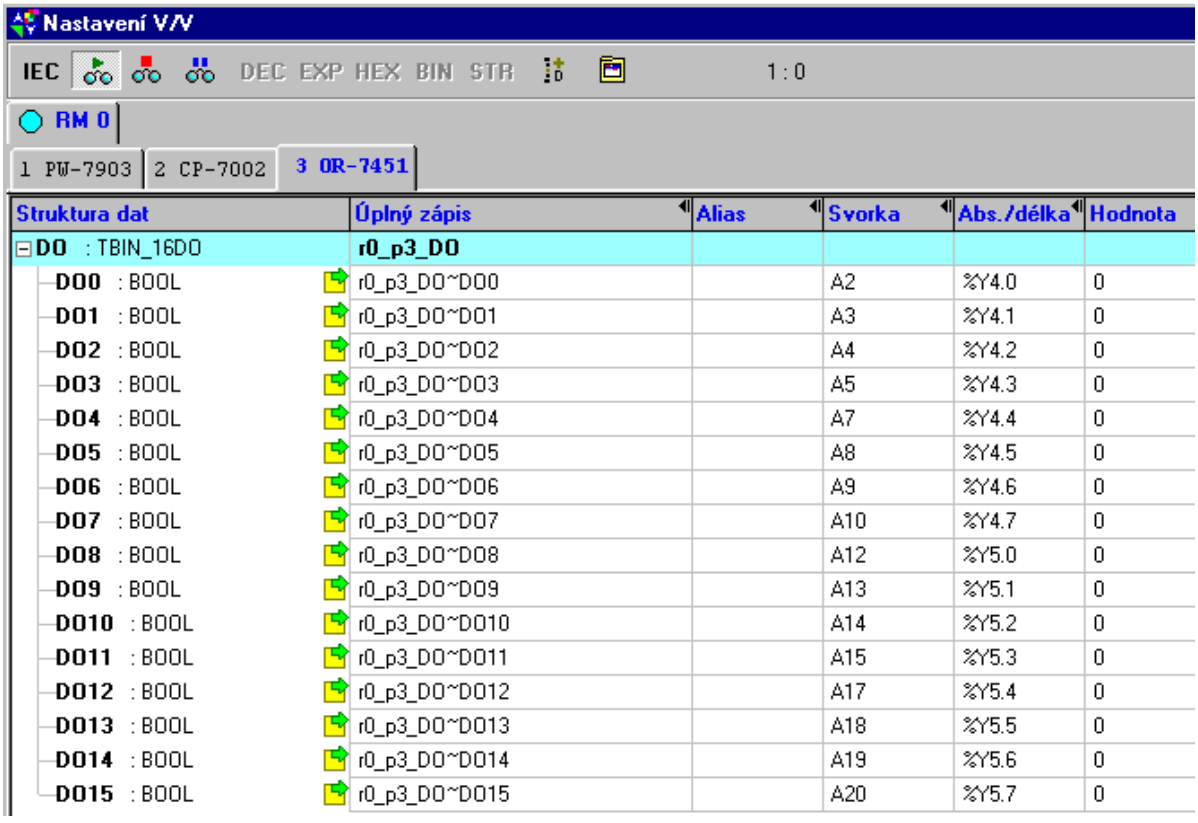
Fig. 10.3 Module SW setup

Switching on of transmission of digital outputs

By enabling the option *Zapnuto pro n. osmici* (ON for the n-th figure of eight), transmission of current states of the corresponding figure of eight of outputs from the PLC scratchpad to the module is allowed. If this option is not enabled for a figure of eight of outputs, the relevant values will not be transmitted. The first figure of eight corresponds to the outputs DO0 ÷ DO7, the second figure of eight corresponds to the outputs DO8 ÷ DO15.

10.10 TRANSMITTED DATA STRUCTURE

The digital output module OR-7451 operates 16 output digital signals. In the data being transmitted, each output signal is represented by one variable of Boolean type. The structure items of the digital module have symbolic names assigned, beginning with the rack number and position number in the rack. In the column *Úplný zápis (Full Write)*, concrete symbolic name is specified for the given item. If you want to use the data in the user program, you will use either this symbolic name or you will write your symbolic name in the column *Alias*, that can be used later. Do not use absolute operands in any case, since they can change after a new compilation of the user program. The structure of passed data is obvious from the panel *Nastavení V/V (Setting V/V)* in the MOSAIC development environment (icon).



Struktura dat	Úplný zápis	Alias	Svorka	Abs./délka	Hodnota
DO : TBIN_16DO	r0_p3_DO				
DO0 : BOOL	r0_p3_DO~DO0		A2	%Y4.0	0
DO1 : BOOL	r0_p3_DO~DO1		A3	%Y4.1	0
DO2 : BOOL	r0_p3_DO~DO2		A4	%Y4.2	0
DO3 : BOOL	r0_p3_DO~DO3		A5	%Y4.3	0
DO4 : BOOL	r0_p3_DO~DO4		A7	%Y4.4	0
DO5 : BOOL	r0_p3_DO~DO5		A8	%Y4.5	0
DO6 : BOOL	r0_p3_DO~DO6		A9	%Y4.6	0
DO7 : BOOL	r0_p3_DO~DO7		A10	%Y4.7	0
DO8 : BOOL	r0_p3_DO~DO8		A12	%Y5.0	0
DO9 : BOOL	r0_p3_DO~DO9		A13	%Y5.1	0
DO10 : BOOL	r0_p3_DO~DO10		A14	%Y5.2	0
DO11 : BOOL	r0_p3_DO~DO11		A15	%Y5.3	0
DO12 : BOOL	r0_p3_DO~DO12		A17	%Y5.4	0
DO13 : BOOL	r0_p3_DO~DO13		A18	%Y5.5	0
DO14 : BOOL	r0_p3_DO~DO14		A19	%Y5.6	0
DO15 : BOOL	r0_p3_DO~DO15		A20	%Y5.7	0

Fig. 10.4 Data structure of digital module OR-7451

The module data structure is generated by the Mosaic program automatically (according to Setup V/V) to file HWconfig.ST.

```
TYPE
  TBIN_16DO : STRUCT
    DO0   : BOOL;
    DO1   : BOOL;
    DO2   : BOOL;
    DO3   : BOOL;
    DO4   : BOOL;
    DO5   : BOOL;
    DO6   : BOOL;
    DO7   : BOOL;
    DO8   : BOOL;
    DO9   : BOOL;
    DO10   : BOOL;
    DO11   : BOOL;
    DO12   : BOOL;
    DO13   : BOOL;
    DO14   : BOOL;
    DO15   : BOOL;
  END_STRUCT;
END_TYPE


VAR_GLOBAL
  r0_p3_DO              AT %Y4    : TBIN_16DO;
END_VAR
```

Variable DO

The value passed in variable DOx corresponds to the state of the output signal of the corresponding output.

10.11 APPENDIX FOR ADVANCED USERS

The structures given below are typically automatically generated by the MOSAIC development environment (into file *.HWC) and it is not recommended to alter them. If the programmer does not use automatic configuration generation, the description below serves as a sample for manual module configuration.

10.11.1 Initialization data structure

The module requires an initialization table, this is represented in the declaration file of the MOSAIC development environment (*.HWC) by the following description:

```
#struct _TTS_Head                ;module heading structure
        UINT  ModulID,           ;module type identification code
        USINT Stat0,             ;status of data exchange
        USINT Stat1              ;status of data exchange

#struct _TTS_OR7451              ;module initialization table structure
        _TTS_Head  Head,         ;heading
        USINT[2]   EDO           ;activation of figures of eight of outputs
```

Example of declaration of initialization table :

```
#table _TTS_OR7451 _r0_p3_Table = 7451,$00,$00,   ;table heading
                                  $80,$80         ;activation of figures of
                                                  ;eight of outputs
```

Example of declaration of module :

```
#struct TModulE1                ;module declaration structure
        USINT version,          ;description version
        USINT rack,             ;rack address
        USINT address,          ;module address in the rack
        UINT  LogAddress,       ;logic address
        UINT  LenInputs,        ;length of input data zone
        UINT  LenOutputs,       ;length of output data zone
        DINT  OffsetInputs,     ;position of input data zone
        DINT  OffsetOutputs,    ;position of output data zone
        UINT  InitTable         ;initialization table index

#module TModulE1 1, 0, 3, 0, 0, 2, 0, __offset(r0_p3_DO),
 __indx (_r0_p3_Table)
```

The meanings of the items of the initialization table:

ModulID - module type identification code, here 7451

STAT0,STAT1 - data exchange status, here 0

EDO - activation of operation of the figure of eight of digital outputs
= $80 - the figure of eight of outputs will be operated
= $00 - the figure of eight of outputs will not be operated

10.12 MODULE CONNECTION EXAMPLES

In preparation

11. DIGITAL OUTPUT MODULE OR-7453

The OR-7453 module is equipped with 8 relay outputs - 4 make and 4 break make contacts. The module is fitted with a connector allowing the customer to make a choice of several variants selected and ordered separately by the customer (order numbers TXN 102 3x). The connectors are described in the documentation TXV 102 30 or in the Manual for designing TXV 001 08.01.

11.1 BASIC PARAMETERS

Product standard	ČSN EN 61131-2
Protection class of electrical object ČSN 33 0600	II
Connection	Removable connector, max. 2,5 mm2 conductor per terminal
Type of equipment	Built-in
Coverage (after installation into rack)	IP20 ČSN EN 60529
Dimensions	137 x 30 x 198 mm

11.2 OPERATIONAL CONDITIONS

Class of ambient influence – ČSN 33 2000-3	Normal
Operating temperatures range	0 °C to + 55 °C
Permissible temperatures during transport	-25 °C to +70 °C
Relative humidity	10 % to 95 % without condensation
Atmospheric pressure	Min. 70 kPa (< 3000 m above see level)
Degree of pollution - ČSN EN 61131-2	2
Overvoltage category of installation - ČSN 33 0420-1	II
Working position	Vertical
Type of operation	Continuous
Electromagnetic compatibility	
Emissions - ČSN EN 55022*	Class A
Immunity	Table 16, ČSN EN 61131-2
Vibration resistance (sinusoidal vibrations) Fc according to ČSN EN 60068-2-6	10 Hz to 57 Hz amplitude 0,075 mm, 57 Hz to 150 Hz acceleration 1G

* This is a product of Class A. In indoor conditions (i.e. such conditions, where using of radio and TV sets can be supposed in a distance of 10 m from the mentioned equipment), the product can cause radio disturbances. It might be required in such cases that the user takes necessary measures to avoid this.

11.3 ELECTRICAL PARAMETERS

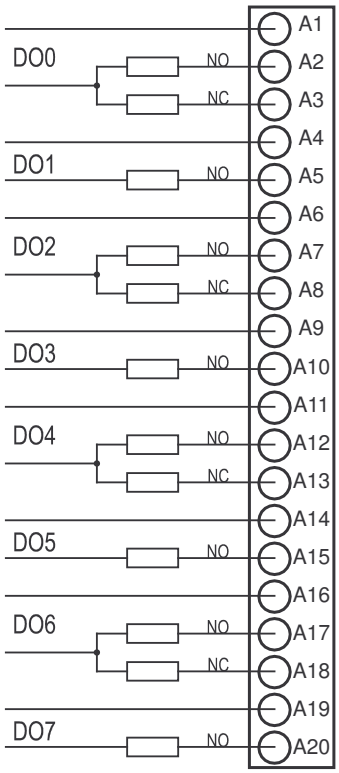
Number of outputs		8
Number of outputs in the group		1
Galvanic isolation from internal circuits		Yes
Diagnostics		Yes, signalization of closed contact on module panel
Common pole		No
Type of outputs		Electromechanical relay, unprotected output
Type of contact		4 brake make and 4 make contacts
Switching voltage	Max.	250 V
	Min.	12 V
Switching current	Max.	3 A
	Min.	100 mA
Short time overload capacity of output	Max.	6 A
Switch on period of contact	Typ.	5 ms
Switch off period of contact	Typ.	6 ms
Contact bounce period	Typ.	1 ms
Limit values for switching load:		
- for resistance load	Max.	3 A at 30 V DC or 230 V AC
- for inductive load DC13	Max.	3 A at 30 V DC
- for inductive load AC15	Max.	3 A at 230 V AC
Switching rate without load	Max.	1200 switchings / min
Switching rate with nominal load	Max.	6 switchings / min
Mechanical lifetime	Min.	5 000 000 cycles
Electric lifetime at max. load:		
- for resistance load	Min.	400 000 cycles
- for inductive load DC13	Min.	7 000 cycles
- for inductive load AC15	Min.	100 000 cycles
Short-circuit protection		External
Inductive load treatment		external RC member, varistor, diode (DC)
Insulation voltage among inputs and internal circuits		3750 V AC
Insulation voltage among groups of inputs among each other		1000 V AC
Module output loss	Max.	2,4 W
Module input power taken from system source	Max.	2,4 W

11.4 POWER SUPPLY

The module is fed from the power supply source, which is part of the TC700 system assembly.

11.5 CONNECTION

The module is fitted with a connector (order number of connector TXN 102 3x, according to customer's choice). The connection of the connector is illustrated on Fig. 11.1.



DOx	output terminals of output x
NO	output make contact
NC	output break make contact

Fig. 11.1 Connection of terminal board of module OR-7453

Detailed information on connection, proper installation procedure, examples of module connection and principles for increasing resistance and reliability can be found in the handbook for designing TXV 001 08.01.

11.6 OPERATION

11.6.1 Module HW configuration

The module is operated, set and diagnosed from the MOSAIC development environment. No setup is made on the module itself.

11.6.2 Putting in operation

After putting the module into the rack and switching power supply on, the module is fully ready for operation and does not require any other settings of its elements.

11.7 DIAGNOSTICS

The basic diagnostic system of the module is part of the standard module software. The diagnostic system becomes active after module power supply is on, and works independently from the user.

11.8 INDICATION

On the front panel of the module, one green indication LED is assigned to each output digital signal. Further, there is a green RUN LED on the front panel. If the LED is on, the module is in the HALT mode, if the RUN LED is flashing, the module is in the RUN mode. Additionally, there is a yellow BLK LED on the front panel and when this is on, blocking of digital outputs is indicated.

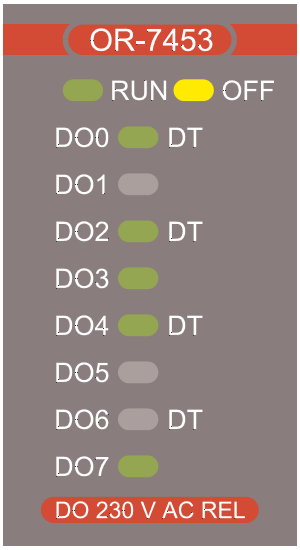


Fig. 11.2 Indication panel of module OR-7453

11.9 MODULE SETUP

For a trouble-free module operation it is necessary to perform its SW setup within the frame of module declaration. The activation of the operation of digital outputs is carried out by figures of eight. Each figure of eight can be enabled or disabled individually. Module setup is carried out within the MOSAIC development environment by means of the dialog given below.

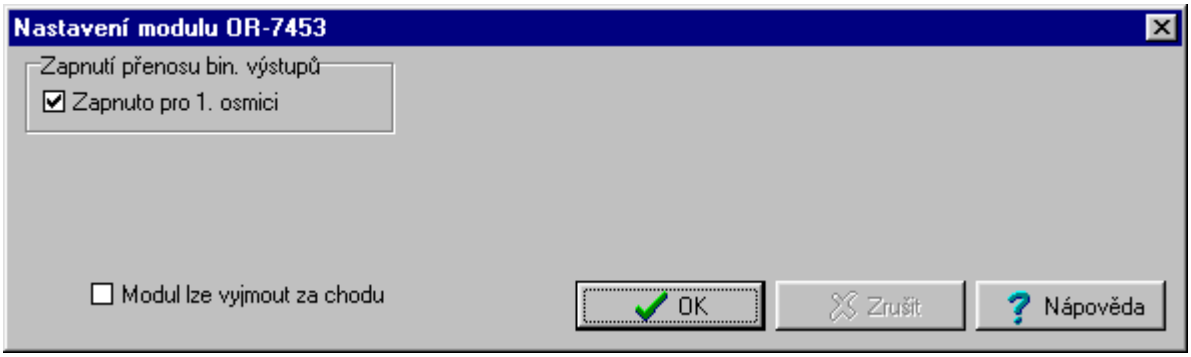


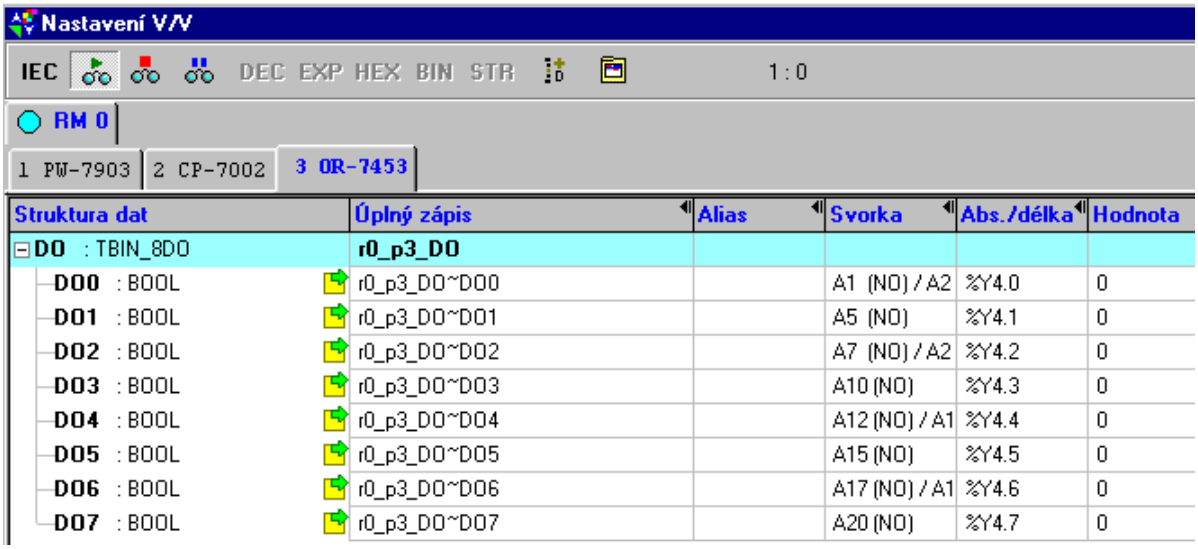
Fig. 11.3 Module SW setup

Switching on of transmission of digital outputs

By enabling the option *Zapnuto pro n. osmici* (ON for the n-th figure of eight), transmission of current states of the corresponding figure of eight of outputs from the PLC scratchpad to the module is allowed. If this option is not enabled for a figure of eight of outputs, the relevant values will not be transmitted. The first figure of eight corresponds to the outputs DO0 ÷ DO7.

11.10 TRANSMITTED DATA STRUCTURE

The digital output module OR-7453 operates 8 output digital signals. In the data being transmitted, each output signal is represented by one variable of Boolean type. The structure items of the digital module have symbolic names assigned, beginning with the rack number and position number in the rack. In the column *Úplný zápis (Full Write)*, concrete symbolic name is specified for the given item. If you want to use the data in the user program, you will use either this symbolic name or you will write your symbolic name in the column *Alias*, that can be used later. Do not use absolute operands in any case, since they can change after a new compilation of the user program. The structure of passed data is obvious from the panel *Nastavení V/V (Setting V/V)* in the MOSAIC development environment (icon).



Struktura dat	Úplný zápis	Alias	Svorka	Abs./délka	Hodnota
DO : TBIN_8DO	r0_p3_DO				
DO0 : BOOL	r0_p3_DO~DO0		A1 (NO) / A2	%Y4.0	0
DO1 : BOOL	r0_p3_DO~DO1		A5 (NO)	%Y4.1	0
DO2 : BOOL	r0_p3_DO~DO2		A7 (NO) / A2	%Y4.2	0
DO3 : BOOL	r0_p3_DO~DO3		A10 (NO)	%Y4.3	0
DO4 : BOOL	r0_p3_DO~DO4		A12 (NO) / A1	%Y4.4	0
DO5 : BOOL	r0_p3_DO~DO5		A15 (NO)	%Y4.5	0
DO6 : BOOL	r0_p3_DO~DO6		A17 (NO) / A1	%Y4.6	0
DO7 : BOOL	r0_p3_DO~DO7		A20 (NO)	%Y4.7	0

Fig. 11.4 Data structure of digital module OR-7453

The module data structure is generated by the Mosaic program automatically (according to Setup V/V) to file HWconfig.ST.

```
TYPE
  TBIN_8DO : STRUCT
    DO0   : BOOL;
    DO1   : BOOL;
    DO2   : BOOL;
    DO3   : BOOL;
    DO4   : BOOL;
    DO5   : BOOL;
    DO6   : BOOL;
    DO7   : BOOL;
  END_STRUCT;
END_TYPE
```

```
VAR_GLOBAL
  r0_p3_DO              AT %Y4    : TBIN_8DO;
END_VAR
```

Variable DO

The value passed in variable DOx corresponds to the state of the output signal of the corresponding output.

11.11 APPENDIX FOR ADVANCED USERS

The structures given below are typically automatically generated by the MOSAIC development environment (into file *.HWC) and it is not recommended to alter them. If the programmer does not use automatic configuration generation, the description below serves as a sample for manual module configuration.

11.11.1 Initialization data structure

The module requires an initialization table, this is represented in the declaration file of the MOSAIC development environment (*.HWC) by the following description:

```
#struct _TTS_Head                ;module heading structure
        UINT  ModulID,           ;module type identification code
        USINT Stat0,             ;status of data exchange
        USINT Stat1              ;status of data exchange

#struct _TTS_OR7453              ;module initialization table structure
        _TTS_Head  Head,         ;heading
        USINT      EDO           ;activation of figures of eight of outputs
```

Example of declaration of initialization table :

```
#table _TTS_OR7453 _r0_p3_Table = 7453,$00,$00,   ;table heading
                                  $80             ;activation of figures
                                                  ;of eight of outputs
```

Example of declaration of module :

```
#struct TModulE1                 ;module declaration structure
        USINT version,           ;description version
        USINT rack,              ;rack address
        USINT address,           ;module address in the rack
        UINT  LogAddress,        ;logic address
        UINT  LenInputs,         ;length of input data zone
        UINT  LenOutputs,        ;length of output data zone
        DINT  OffsetInputs,      ;position of input data zone
        DINT  OffsetOutputs,     ;position of output data zone
        UINT  InitTable          ;initialization table index

#module TModulE1 1, 0, 3, 0, 0, 1, 0, __offset(r0_p3_DO),
 __indx (_r0_p3_Table)
```

The meanings of the items of the initialization table:

ModulID - module type identification code, here 7453

STAT0,STAT1 - data exchange status, here 0

EDO - activation of operation of the figure of eight of digital outputs
= $80 - the figure of eight of outputs will be operated
= $00 - the figure of eight of outputs will not be operated

MODULE CONNECTION EXAMPLES

Example 1 The following actuators are connected to the module:
- 1 three-point controlled actuating mechanism
- 1 magnetic valve
- 1 external relay

The digital output module OR-7453 has 8 relay outputs. The outputs are realized alternately by break make and make contacts (outputs 0, 2, 4 and 6 break make contacts, outputs 1, 3, 5 and 7 are make contacts).

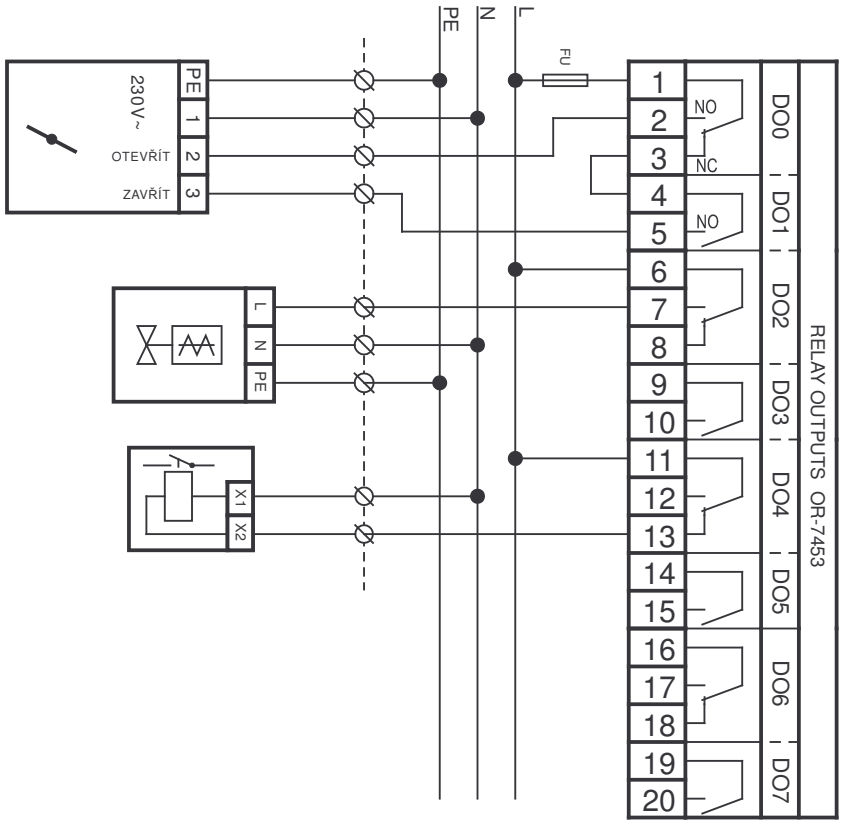


Fig. 11.5 Connector of module OR-7453 (connection example)

Notes:
1. *Outputs DO0 and DO1 represent three-point control with blocking of switching of both outputs at the same time.*
2. *The insulation among the outputs is a working insulation – thus it is not possible to control the low voltage 230 V circuits by one module output and the SELV circuits by another output.*

Notes

Objednávky a informace:
Teco a. s. Havlíčkova 260, 280 58 Kolín 4, tel. 321 737 611, fax 321 737 633

TXV 004 20.01