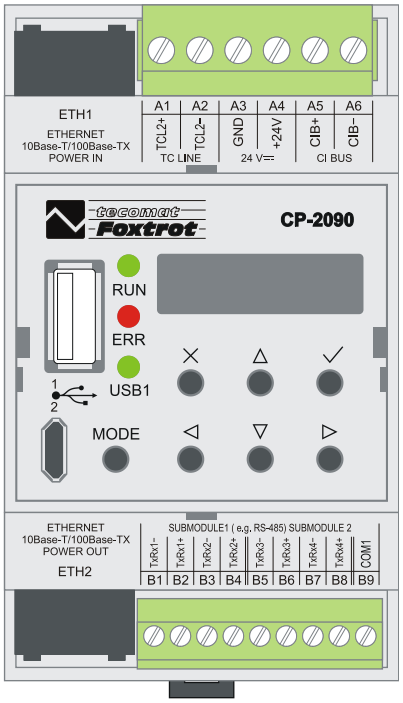
TECO
Advanced Automation



PROGRAMMABLE CONTROLLERS
TECOMAT FOXTROT
CP-2090

PROGRAMMABLE CONTROLLERS
TECOMAT FOXTROT
CP-2090

TXV 004 53

1. edition - May 2019

CONTENT

1. FIRST ACQUAINTANCE WITH TECOMAT FOXTROT 2 PROGRAMMABLE LOGIC CONTROLLERS

TECOMAT FOXTROT 2 programmable controllers represent a new generation of control systems based on the previous TECOMAT FOXTROT series. These are small compact machines with the possibility of modular expansion. They combine the advantages of compact automata in terms of size and modular systems in terms of scalability and variability.

The individual modules of the system are enclosed in plastic protective cases, which are mounted on the U-rail ČSN EN 50022. Thanks to this, they can be handled without risk of damage to sensitive CMOS components. The whole system is designed according to the standard ČSN EN 61131.

The basis of the system

The basis of the FOXTROT 2 system is a basic module containing a central unit, various combinations of inputs and outputs and in most variants also a built-in display of 4 x 20 characters and 7 buttons.

Communication interface

The basic modules of the TECOMAT FOXTROT 2 series are equipped with two independent 10/100 Mb Ethernet interfaces. Optionally, they may include a WLAN interface for WiFi communication and an LTE interface for communication over a GSM network.

For serial communication, up to 2 submodules containing 1 or 2 serial channels with RS-232 or RS-485 interfaces can be optionally installed in the basic module. So the basic module can be equipped with a maximum of four serial channels. An additional 6 serial channels can be added using the SC-11xx modules on the TCL2 bus. RS-232 / RS-485 interfaces, CAN interfaces and wireless networks are available here.

Construction of an extensive system

The PLC base module can be extended by connecting peripheral modules if necessary. The expansion peripheral modules are connected to the central unit via serial buses. As a result, the individual parts of the TECOMAT FOXTROT system can be deployed in a decentralized manner so that the individual modules are located directly next to the controlled technologies and thus save power cabling.

Connection with superior system

The entire system can communicate with master systems (computers [NOHRES]PC, operator panels, etc.), which can be used for both monitoring and controlling the controlled process. The personal computer is also used to create and debug the PLC user program.

2. FOXTROT CP - 2090 BASIC PARAMETERS

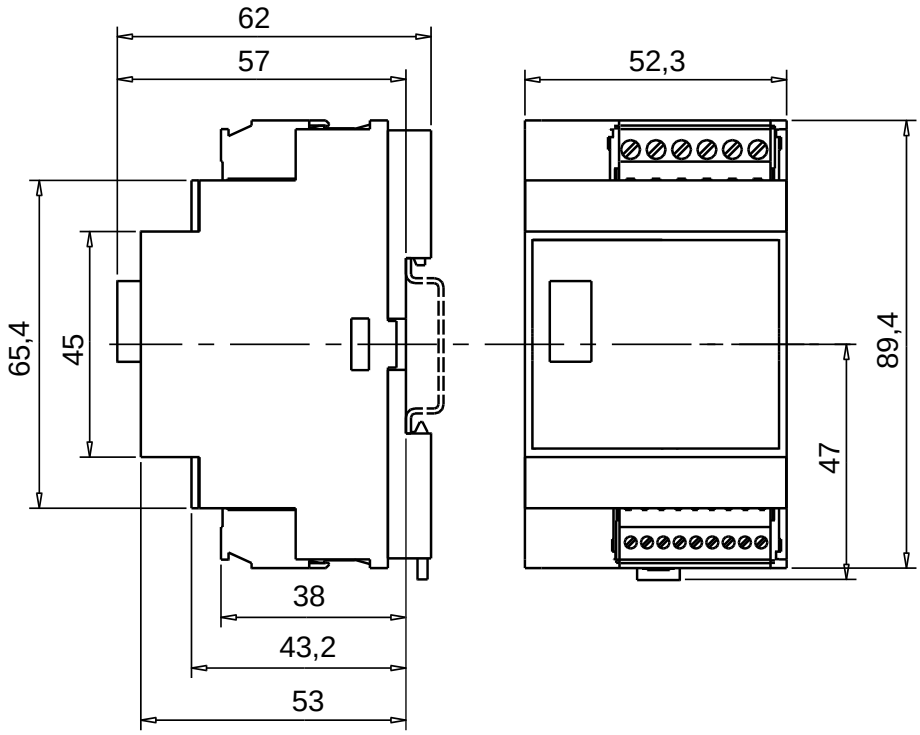
2.1. TECOMAT FOXTROT 2 SYSTEM PARAMETERS

The TECOMAT FOXTROT 2 PLCs are designed for U-rail mounting. Plastic module housings allow installation in standard house distribution boards. The basic parameters of the PLC are shown in Table 2.1 to Table 2.5.

All modules of the FOXTROT 2 PLC are equipped with a plastic protective case and a holder for mounting the module on the U-rail.

Attention!	**The modules contain components sensitive to electrostatic charge, therefore we observe the principles for working with these circuits! Handling is performed only on the module with disconnected power supply of both the module itself and the input and output signals!**

The widths of all modules of the assembly are always the whole multiple of the dimension 17.5 mm marked with the letter M. This value usually corresponds to the width of circuit breakers and other wiring elements mounted on the U-rail. The width of the base module CP-2090 corresponds to 3M, the width of the peripheral modules corresponds to 4M, 3M or 1M. The dimensions of the basic modules are shown in Pic. 2.1.



Pic.2.1 Dimensions of basic modules CP-2090

Tab.2.1 Basic parameters

Product standard	ČSN EN 61131-2:2008 (idt IEC 61131-2:2007)
Protection class of electrical object (ČSN EN 61140:2003, idt IEC 61140:2001)	II
Type of device	built-in
Degree of protection (ČSN EN 60529:1993, idt IEC 529:1989)	IP20
Lifetime	10 years

Tab.2.2 Operating conditions

Spaces (ČSN 33 2000-3:1995, idt. IEC 364-3:1993)	normal
Operating temperature range	–20 °C up to + 55 °C
Permissible temperature during transport	–25 °C up to +70 °C
Relative air humidity	10 % up to 95 % without condensation
Atmospheric pressure	min. 70 kPa (< 3000 m n. m.)
Degree of pullution (ČSN EN 60664-1:2004, idt. IEC 60664-1:1992)	1
Overvoltage category of installation (ČSN EN 60664-1:2004, idt. IEC 60664-1:1992)	II
Working position	vertical
Type of operation	permanent
Vibration resistance (sine wave)[1]	10 up to 57 Hz - amplitude 0,075 mm 57 up to 150 Hz - acceleration 1G
Electromagnetic compatibility: Emission (EN 55022:1999, idt. CISPR22:1997)	Class A [2]
Immunity	min. as required ČSN EN 61131-2:2008

[1] Fc test according to EN 60068-2-6: 1997 (idt IEC 68-2-6: 1995), 10 cycles per axis.

[2] This product may cause radio interference in areas where radio and television receivers are expected to be within 10 m of the listed equipment. In this case, the user may be required to take appropriate action.

Tab.2.3 Storage conditions

Storage environment	dry clean rooms without conductive dust, aggressive gases or acid vapors for a period not exceeding the warranty period
Storage temperatures	–25°C up to +70°C without sudden temperature changes
Relative humidity	max. 80% without condensation vapors

Tab.2.4 Transport conditions

Transport environment	covered transport means, transport packaging must not be exposed to rain and snow
Transport temperatures	–25°C up to +70°C

Tab.2.5 System characteristics

Executing the user program . cyclic, multi-loop control
User program . programming according to IEC 61131 (languages: ST, LD, FBD, CFC, SFC) . 1 MB memory for user program code . 320 KB for program variables, of which max. 48 KB backed up (RETAIN) . automatic saving of program code in non-volatile memory . optional automatic saving of program source code in PLC system during programming . uploading user program to PLC via USB / Ethernet / WiFi / LTE
Basic PLC modes . RUN - user program execution, technology control . HALT - stop execution of user program, PLC programming . possibility to change the mode by command over the communication channel
Blocking of PLC outputs . command over the communication channel . automatically after a serious system error
Hardware diagnostics . processor check (Watchdog) . monitoring of supply voltage (power fail), data protection in case of power failure . Serial communication security . securing data transmission over the I / O bus
Software diagnostics . validation of the user program . monitoring the cycle time of the user program . continuous checking of the correctness of the user program (non-existent jump destination, memory structure overflow, division by zero, unknown instruction, etc.)
Communication . serial in EPSNET, MODBUS, CAN . general serial asynchronous . Ethernet interface UDP / TCP / IP, USB host, USB device, WLAN, LTE, RS-232, RS-485
Other functions . automatic recognition of connected peripheral modules . user program backup and project archiving in PLC memory . communication support for data monitoring by superior system . possibility to execute a user program without activating peripheral modules . additional memory for DataBox data archiving . RTC circuit . support for PLC variable analyzer . possibility of fixation of inputs and outputs of peripheral modules . program change on the fly (online editing) . micro SD card . integrated Web server . Datalogger function

2.2. ZÁKLADNÍ MODULY TECOMAT FOXTROT CP-2090

Basic module assembly

The TECOMAT FOXTROT CP-2080 basic module contains a central unit with two independent Ethernet interfaces, one USB device interface for connecting a master system and one USB host interface for connecting external memory (USB Flash drive).

The peripheral part of the basic module contains 4 binary inputs, 6 relay outputs and 2 transistor outputs.

The basic module has an integrated display of 4 x 20 characters and 7 buttons. In addition to system setup and diagnostics, the display and buttons can also be used in the user program.

The basic module also includes a slot for mounting an additional micro SD memory card (not available with WLAN1). Some variants of the basic module are equipped with internal WLAN1 interface for WiFi network or LTE1 interface for GSM network (see below).

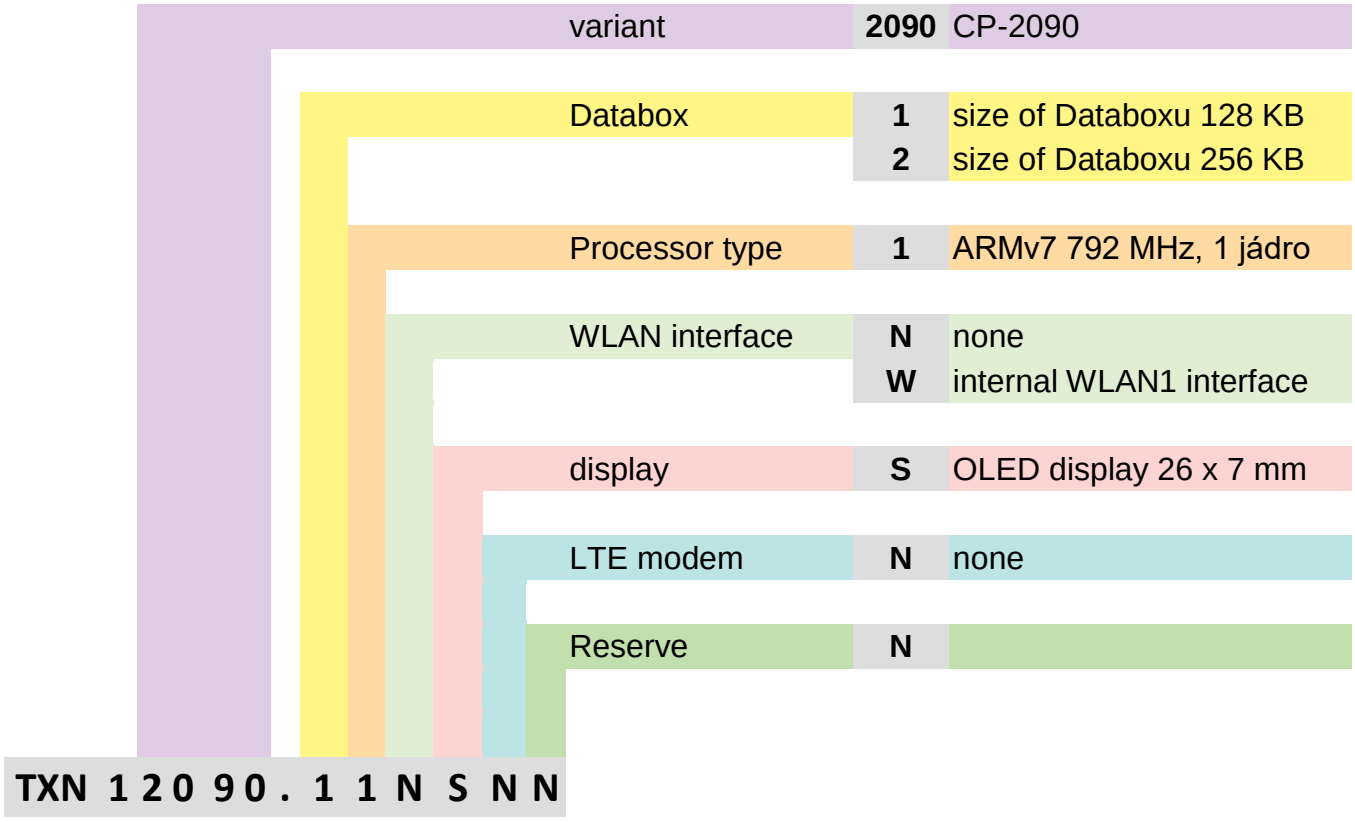
The TCL2 system bus for communication with FOXTROT family peripheral modules and the CIB Common Installation Bus® (trademark of Teco a.s., hereinafter referred to as CIB) for communication with CFox family modules can be connected to the base module.

Optionally, the basic module can be equipped with two submodules with serial channels.

Basic module variants

The TECOMAT FOXTROT CP-2080 basic module is available in several variants distinguished by a combination of numbers and characters following the dot in the order number (eg TXN 120 80.11NSNN). In this way, the combined variants with different memory sizes for the DataBox, with optionally fitted WLAN1 and LTE1 interfaces and with different integrated display sizes are defined. The principle of marking individual variants is given in Table 2.6.

Tab.2.6 Designation of variants of basic modules TECOMAT FOXTROT CP-2080



Note.: If there is no WLAN1, you can use the internal micro SD card slot. If the WLAN1 interface is fitted, the use of an additional micro SD card is not possible.
The CP-2090 basic module cannot be fitted with LTE1.
All CP-2090 variants have an integrated 26 x 7 mm display.

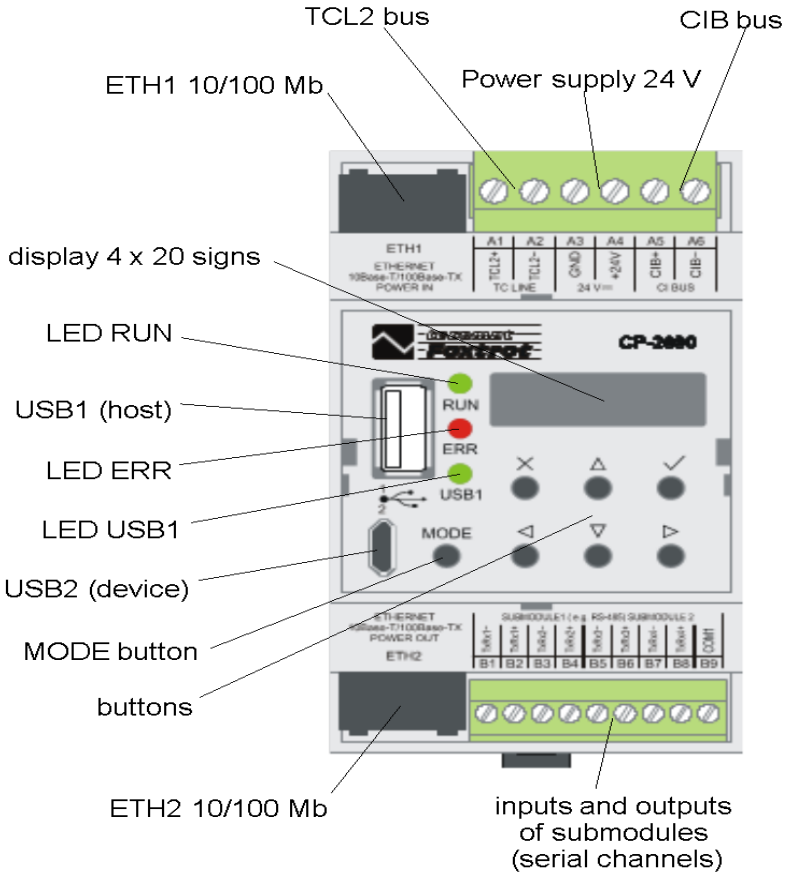
As shown in Table 2.6, a specific TXN 120 90.11NSNN is the CP-2090 basic module with 128 KB of DataBox memory, a single core ARMv7 792 MHz processor, no internal WLAN1 interface, and an integrated display of 26 x 7 mm.

An overview of the features of variants of the basic modules CP-2090 is given in Table 2.7.

Tab.2.7 Variants of basic modules CP-2090

Type	Description	Order number
Common features of basic modules CP-2090:		
CP-2090	central unit series I OLED display 4 x 20 characters, 6 user buttons 2 10/100 Mb Ethernet interfaces 1 USB device interface 1 USB host interface 1 TCL2 bus line 1 CIB bus line 2 slots for submodules with serial channels (up to 4) or other devices	TXN 120 90.x1xSNN
Other features of individual variants:		
	choice of DataBox memory size (available for all variants) - 128 KB DataBox memory - 256 KB DataBox memory	 TXN 120 80.11xSNN TXN 120 80.21xSNN
	optional internal WLAN1 interface - unfitted - fitted	 TXN 120 80.x1NSNN TXN 120 80.x1WSNN

Basic parameters of the basic modules CP-2090 are shown in Table 2.8



Pic.2.2 CP-2090 basic module without WLAN1 (TXN 120 90.x1NSNN)

Tab.2.8 Basic parameters of basic modules

Type of central unit	CP-2090
Module power supply	
Supply Voltage (SELV)	24 V DC, +25%, –15%
Internal protection	reversible fuse
Maximum power consumption	10 W
Connecting the wires to the module	
Type of terminals	removable terminal blocks
Conductor cross-section - power supply, buses, inputs and outputs - bringing out submodules	 max. 2,5 mm^2 max. 1,5 mm^2
Ethernet interface	RJ-45 connector
USB device interface	connector type micro B
USB host interface	connector type A
Mechanical design of the module	
Module dimensions	53 × 92 × 63 mm
Module width in multiples of M (17.5 mm)	3M
Holder for U rail	yes
Inputs and outputs	
	-
Communication channels	
10/100 Mb Ethernet interface	2
USB device interface	1
USB host interface	1
WLAN interface	optional
Serial channels on submodules	4
Additional serial channels via separate modules SC-11xx on TCL2 bus	6
User display	
User display (number of characters)	4 x 20
Number of custom buttons	6
Connectable peripheral modules	
TCL2 bus - number of lines - range	1 10 I / O modules, 4 operator panels
CIB bus - number of internal lines [3] - range	 1 32 CFox I / O modules

[1] The CP-2090 modules have an internal CIB power supply, the power of which allows modules to be consumed less than 100 mA on the CIB. In case of higher consumption, the external separation module C-BS-0001M should be used.

Power supply for the basic module and bus connection

CP-2090 basic modules are supplied with 24 V voltage, which is connected to terminals A3 and A4 in the field marked 24 V DC. It should be noted that both internal and peripheral circuits (with the exception of relay outputs and submodules) are not galvanically isolated. Therefore, the terminal A3 has the common ground of the whole module.

Attention! Pay special attention to connecting the supply voltage. If 24 V is connected to terminals other than the power supply, part of the system may be destroyed!

In the TC LINE field, the TCL2 system bus is connected to terminals A1 and A2, which is used to connect additional peripheral modules (Chapter 2.3.). The connection is made by connecting one TCL2 + terminal of all modules and the other TCL2– terminal. For details, refer to the TECOMAT FOXTROT 2 Programmable Controller (TXV 004 50.01) documentation.

V poli CI BUS je na svorkách A5 a A6 vyvedena sběrnice CIB. For details on the CIB bus and modules connected via this bus, refer to the CIB Bus Peripheral Modules manual (TXV 004 13.01)

Tab.2.9 Wiring of terminal block A

A1	TCL2+	TCL2 system bus
A2	TCL2–	TCL2 system bus
A3	GND	ground of module
A4	+24V	power supply
A5	CIB+	CIB bus
A6	CIB–	CIB bus

The CP-2090 base module can also be powered via the ETH1 interface using a power injector. The 24 V supply voltage is routed through an Ethernet cable after two pairs of wires not used for signals (see chapter 3.3.1.).

The connected operating panel of the ID-3x type can be powered via the ETH2 interface (see chapter 3.3.1.).

2.3. TECOMAT FOXTROT PERIPHERAL MODULES

Peripheral modules of FOXTROT system

All peripheral modules of the FOXTROT system listed in Table 2.10 are fitted with a plastic protective case and a holder for mounting the module on the U-rail. They are connected to the FOXTROT PLC basic module via TCL2 bus.

For details on these modules, refer to the TECOMAT FOXTROT PLC Peripheral Modules (TXV 004 12.01) manual.

Tab.2.10 FOXTROT system peripheral module variants

Type	Description	Order number
UC-1203	MP-BUS connection for Belimo elements	TXN 112 03
UC-1204	Open Therm bus connection	TXN 112 04
IB-1301	12 24 V binary inputs, 4 of which can be used as counter inputs	TXN 113 01
OS-1401	12 binary transistor outputs 24 V	TXN 114 01
IR-1501	4 24 V binary inputs usable as counter inputs 8 relay outputs	TXN 115 01
IT-1602	8 analog inputs (bipolar low voltage ranges, thermocouples, 16 bit) 2 analog bipolar voltage outputs (10 bits)	TXN 116 02
IT-1604	8 analog inputs (unipolar voltage and current ranges, passive resistance sensors, 16 bit) 2 analog unipolar voltage outputs (10 bits)	TXN 116 04
IT-1605	8 analog inputs (bipolar low voltage ranges, thermocouples, 16 bit, differential connection) 2 analog bipolar voltage outputs (10 bits)	TXN 116 05
OT-1651	4 analog unipolar voltage and current outputs (12 bits)	TXN 116 51
IC-1701	8 binary inputs 5 - 24 V usable as inputs up to 4 counters, 2 counters up to 100 kHz and 2 counters up to 5 kHz depending on the mode 4 transistor outputs 10 - 30 V DC usable as outputs PWM, or for controlling up to 2 stepper motors	TXN 117 01

System communication modules of FOXTROT system

With the help of system communication modules, the FOXTROT 2 PLC can be extended with additional serial channels, which become part of the central apartment unit. Communication parameters are set in the Mosaic development environment within the project.

These modules are equipped with a plastic protective case and a holder for mounting on a U-rail. They are connected to the FOXTROT 2 PLC basic module via TCL2 bus. Due to the transmission capacity of this bus, these serial channels are suitable for data and time-consuming communication. For details on how to install these modules, refer to the TECOMAT FOXTROT PLC Peripheral Modules (TXV 004 12.01) manual.

For a more detailed description of serial communications and their use, see the TECOMAT FOXTROT 2 Programmable Logic Controller (TXV 004 50.01) manual.

Tab.2.11 FOXTROT system peripheral module variants

Type	Description	Order number
SC-1101	1 serial channel RS-232 / RS-485 (UNI mode)	TXN 111 01
SC-1102	1 CAN bus line (CSJ mode)	TXN 111 02
SC-1111	communication with RFox 2 wireless devices (UNI mode)	TXN 111 11
SC-1112	wireless M-Bus communication (UNI mode)	TXN 111 12

Operator panels

The operator panels listed in Table 2.12 are connected to the basic PLC FOXTROT module by means of TCL2 bus, ie the same as common peripheral modules. Up to four panels can be connected to one base module.

Tab.2.12 Variants of operator panels connectable to the FOXTROT system on the TCL2 bus

Type	Description	Order number
ID-14	4 x 20 characters display, 25 buttons	TXN 054 33

Text operator panel ID-14

The ID-14 operator panel features a 4 x 20 character display and 25 buttons. The display supports Windows character sets CP1250 (WinLatin2 - Central European), CP1251 (WinCyrillic - Cyrillic) and CP1252 (WinLatin1 - Western European).

For correct connection, select the Foxtrot CPU type in the panel setting mode, and then set the panel address (position address) in the range of 8 to 11 (if several panels on one bus must naturally have each other address). The rack address must always be 0.

The ID-14 operator panel enables the installation of a short U-rail, on which the basic FOXTROT PLC module can be mounted.

This makes it easy to obtain a compact PLC with display and keyboard.

For detailed information on connecting and operating the ID-14 panel, refer to the ID-14 Operator Panel (TXV 002 33.01) manual.

Attention!

All modules contain components sensitive to electrostatic charge, therefore we follow the rules for working with these circuits!

Handling is performed only on the module with disconnected power supply of both the module itself and the input and output signals!

3. CENTRAL UNIT CP-2090

Central unit properties

The central unit is the main component of the FOXTROT 2 PLC basic module. Its main task is to execute the user program, control the PLC inputs and outputs and communicate with the PLC environment.

Each central unit in TECOMAT PLC systems is assigned a letter that determines the series. Each row of central units has its specific features important for the user program compiler, such as the size of the instruction file and the way it is coded, variable mapping, and the amount of memory space, etc.

Tab.3.1 Basic parameters of the central unit CP-2090

Module type	**CP-2090.x1xxxx ARMv7 792 MHz, 1 core**
Row of central unit	I
User program memory	1 MB
Instruction length	4 bytes
Backup of program source code in PLC	yes, optional in Mosaic
On-line program change in PLC	yes, including changes to I / O settings
Memory for user program variables	320 KB
of which for RETAIN variables	48 KB
IEC timers / counters	supported
Number of IEC timers / counters	limited by memory size only
Cycle time per 1k of logic instructions	0,036 ms
Cycle time for 1k integer operations	0,043 ms
Cycle time for 1k floating point operations	0,044 ms
Additional DataBox memory (internal)	128 / 256 KB (by variant)
Memory for I / O data	64 KB / 64 KB
File system	
PLC internal disc	128 MB, journaling FS
RAM disc PLC	16 MB
USB Flash disc	supported
Micro SD card	supported (except for variants with WLAN1)
Development environment	Mosaic v2018.2 or higher
Programming languages	ST, LD, FBD, CFC, SFC (od 2Q 2019)
Real Time Circuit (RTC)	yes
RTC backup	typ. 500 h
Integrated Web server	yes
Integrated Datalogger	yes
Access to PLC variables via web API	yes

Central units in FOXTROT CP-2090 systems are series I. These units have the following characteristics:

- 1 MB of memory for user programs
- internal 128 MB file system for project archiving
- optional 128/256 KB FRAM memory for archiving DataBox data (size by variant)
- 320 KB of memory for variables, of which 48 KB for RETAIN variables
- RTC real time circuit

- integrated Web server
- integrated Datalogger
- possibility of on-line change of user program (without stopping control)
- Mode and diagnostic messages are displayed on the integrated display.1 MB of memory for user programs
- internal 128 MB file system for project archiving
- optional 128/256 KB FRAM memory for archiving DataBox data (size by variant)
- 320 KB of memory for variables, of which 48 KB for RETAIN variables
- RTC real time circuit
- integrated Web server
- integrated Datalogger
- possibility of on-line change of user program (without stopping control)
- Mode and diagnostic messages are displayed on the integrated display.

Configuration of the whole PLC

Configuration of the whole PLC is done from a web browser at the IP address set by the user or at the address assigned by the DHCP server on port 8080 or 8443. For the factory default ETH1 IP address (192.168.134.176), you must enter http://192.168.134.176:8080 or https://192.168.134.176:8443 in your browser. The computer must be in the same local network as the PLC system. If the PLC IP address is assigned from a DHCP server, it is possible to display this address on the basic module display by using the buttons. The same address must then be entered in the browser's address bar instead of the default IP address.

PLC configuration pages can also be accessed from the browser by entering https: //foxtrot.local: 8443. The advantage of this procedure is that you do not need to know the IP address of the PLC. This option can be used only on computers that support so-called. ZeroConf, which is a technique whereby a PLC computer in a local area network can only communicate by name (foxtrot.local). Only one PLC system can be connected in the local network at a time.

Embedded web server allows

- get information about installed firmware versions and hardware used
- update the entire PLC firmware
- set the PLC date and time, including the time zone
- set automatic time synchronization with NTP server (s)
- access to system logs (system start, boot system, system update)
- setting of all network interfaces (ETH1, ETH2, WLAN1, LTE1)
- PLC parameter settings (EPSNET communication parameters, PLC web server settings, TecoRoute settings, access to PLC log files, application profile management)
- PLC ComS (server) settings
- service settings (Avahi, FTP, Samba)
- web server settings (user settings, certificate settings)

The first time you access the PLC configuration site, you must first enter the login information (access name and password). After login, it is possible to add other users, edit their login data or remove some users (see the Web / Users tab).

If the user loses or forgets the login data, then it is possible to delete the currently set login data in the PLC using the buttons and the display on the basic module. If you then access the configuration site, you will be required to set a new username and password to access.

For details on operation and behavior of the central apartment unit, refer to the TECOMAT FOXTROT 2 programmable logic controllers (TXV 004 50.01) documentation.

3.1. INDICATION ELEMENTS AND SETTINGS

Indication LEDs

The basic modules contain RUN and ERR LEDs, which indicate the central unit mode (see table 3.2). The USB1 LED indicates the status of the USB host.

Tab.3.2 Overview of the function LEDs of the basic module

name	color	behavior	function
RUN	green	shines	central unit working, user program not executed (HALT, PROG mode)
		flashes	the central unit works, the user program is executed (RUN mode)
ERR	red	shines	error indication reported by the central unit
USB1	green	shines	A USB storage device has been connected to the USB host

MODE button

The basic module is equipped with seven buttons. While the six buttons beneath the display are designed for application use, the MODE button on the far left is used to switch the display between user and system display modes.

In RUN mode, the display switches to user mode and displays the texts defined by the running application program. By briefly pressing the MODE button, the display switches to the system mode, displaying the PLC mode. Use the arrow keys to scroll through other screens displaying PLC firmware version information, ETH1 and ETH2 interface parameters, the total size of available storage media, and user program information (name, version, and user program compilation date and time). Pressing the MODE button briefly again switches the display back to user mode.

In other modes, when the user program is not running, the display is switched to system mode by default. If the user program does not operate the display, the display remains in system mode permanently.

After switching on the PLC power supply during the switching sequence, the MODE button has several functions. If the button is not pressed during the switch-on sequence, the PLC switches to one of the operating modes (RUN, HALT with error, etc.).

If you press and hold the MODE button while the PLC firmware version is displayed (after the PLC power is turned on), the following menu appears on the display:

- Set ETH1 - set ETH1 parameters
- Set ETH2 - set ETH2 parameters
- Web Pass - deletion of PLC site configuration data
- Exit - end setting, change to RUN or HALT mode

By means of the buttons marked with cursor arrows we can choose between offered actions. The selection can be made with the ✓ (enter) button, the **X** (cancel) button cancels the selected action.

3.2. BACKUP OF REAL TIME CIRCUIT POWER

When the PLC supply voltage is turned off, the data in the real time and calendar (RTC) circuit is backed up. Backup is provided by supercap, which lasts for about 500 hours.

3.3. COMMUNICATION INTERFACE

As already mentioned, FOXTROT 2 PLC's basic modules include two independent Ethernet interfaces, two USB interfaces. Serial channels are realized using replaceable submodules MR-013x and external modules SC-11xx.

Tab.3.3 Communication options of the central unit

Module type	CP-2090
Rozhraní Ethernet 10/100 Mb	2
Rozhraní USB device	1
Rozhraní USB host	1
Rozhraní WLAN1	By variant
Počet sériových kanálů	
na submodulech MR-0130 - MR-0134	4
na modulech SC-11xx na sběrnici TCL2	6
Sběrnice TCL2	1
Sběrnice CIB	1

Communication options

serial channels on the MR-0130 - MR-0134 submodules
- **UNI** mode - general channel with arbitrary asynchronous communication

serial channels on modules SC-1101, SC-1111, SC-1112
- **UNI** mode - general channel with arbitrary asynchronous communication

serial channels on SC-1102 modules
- **CSJ** mode - CAN bus connection

Ethernet interface ETH1, ETH2, WLAN1, WLAN2, LTE1
- **PC** mode - communication with superior systems by EPSNET UDP and EPSNET TCP protocols in TCP / IP networks
- **PLC** mode - data sharing between PLCs, FOXTROT (CP-1xxx) and TC700 systems can be in the network
- **PLD** mode - data sharing between PLC FOXTROT 2 with possibility to encrypt shared data
- **UNI** mode - general data exchange by UDP and TCP protocols with SSL / TLS encoding support

The communication parameters are set in the Mosaic development environment within the project. The Ethernet, LTE, WLAN interface is configured via the web server directly on the basic module (see below).

The default Ethernet interface setting is as follows:

ETH1 - fixed IP address 192.168.134.176, mask 255.255.255.0, gateway not set
ETH2 - DHCP enabled - IP address assignment expected by DHCP server (including mask, gateway address and DNS server addresses)

A more detailed description of the communication modes can be found in the TECOMAT FOXTROT 2 programmable logic controllers (TXV 004 50.01) documentation.

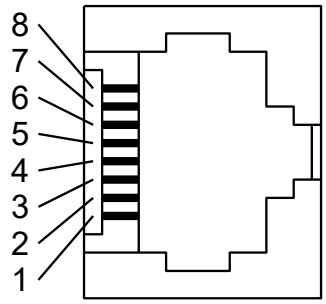
3.3.1. Ethernet interface

The basic modules are equipped with two independent 10/100 Mb Ethernet interfaces labeled ETH1 and ETH2. Each Ethernet interface is fitted with a standard RJ-45 connector. The connector is ready for use with common UTP patch cables. Both interfaces are designed to allow both straight and crossover cables.

The CP-2080 base module can also be powered via the ETH1 interface using a power injector. The 24 V supply voltage is routed through an Ethernet cable of two pairs of wires not used for signals (Table 3.4). Power is supplied to each pole by a pair of wires. The polarity of

the power supply does not matter, it is treated on the PLC side by an input rectifier. As a result, both straight and crossover cables can be used in this case.

Tab.3.4 Connection of ETH1 interface (PLC front view)



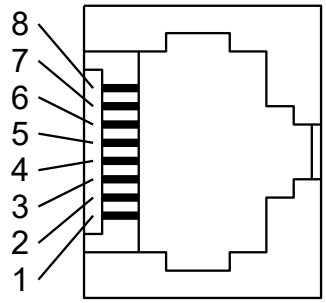
Pin	Signal	Wire color
8	PWRB	Brown
7	PWRB	white / brown
6	RD– or TD–	green or orange
5	PWRA	white / blue
4	PWRA	blue
3	RD+ or TD+	white / green or white / orange
2	TD– or RD–	orange or green
1	TD+ or RD+	white / orange or white / green

PWRA, PWRB one and the other pole of 24 V DC PLC power supply (polarity doesn't matter)
RD+, RD– positive and negative wire of the receiver signal
TD+, TD– the positive and negative conductors of the transmitter signal

Note.: The variant connection of RD and TD signals depends on the cable used (straight or crossed).

The connected ID-3x operating panel can be powered via the ETH2 interface using a power injector. The wiring of the ETH2 interface is similar to the ETH1, except that the 24 V power supply output for the operating panel is shown here (tab 3.5)

Tab.3.5 Connection of ETH2 interface (PLC front view)



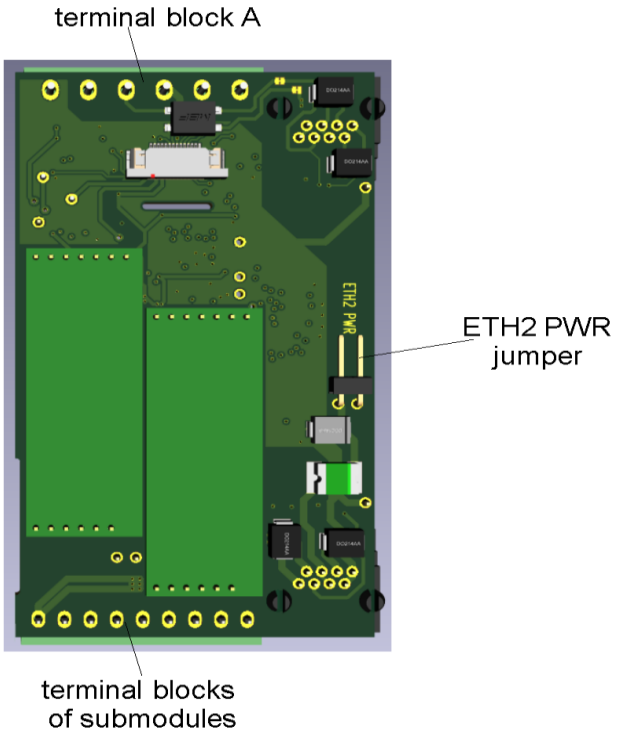
Pin	Signal	Wire color
8	PWO–	Brown
7	PWO–	white / brown
6	RD– or TD–	green or orange
5	PWO+	white / blue
4	PWO+	blue
3	RD+ or TD+	white / green or white / orange
2	TD– or RD–	orange or green
1	TD+ or RD+	white / orange or white / green

PWO+, PWO– positive and negative pole of 24 V DC output for ID-3x operating panel (the jumper must be plugged into position ETH2 PWR)
RD+, RD– the positive and negative wire of the receiver signal
TD+, TD– the positive and negative conductors of the transmitter signal

Note.: The variant connection of RD and TD signals depends on the cable used (straight or crossed). The color of the conductors allows accurate signal identification.

This function is conditioned by inserting the jumper on the tips marked ETH2 PWR on the back of the bottom plate next to the replaceable submodules (Fig. 3.1). You must use a screwdriver to release the latches on the bottom of the PLC base module housing. After removing the bottom of the housing, the bottom plate with replaceable submodules and ETH2 PWR tips is accessible.

ATTENTION! The modules contain components sensitive to electrostatic charge, therefore we follow the rules for working with these circuits!
We only handle the module without power supply!



Pic.3.1 Placement of the ETH2 PWR jumper on the base plate of the basic module after removing the lower part of the housing

3.3.2. USB interface

The basic modules are equipped with a USB host interface with a type A connector for connecting external memory (USB1) and a USB device interface with a micro B connector for connecting the Mosaic development environment (USB2).

3.3.3. Serial channels

The basic module itself does not contain serial channels, but up to 4 serial channels can be supplemented with replaceable submodules MR-0130 - MR-0134. These are standard serial channels with RS-232 or RS-485 interface. Their list and configuration are given in chapter 4.1.1.

An additional 6 serial channels can then be added using the separate SC - 11xx communication modules on the TCL2 bus, which contain both standard serial channels and a connection to the CAN bus or to a wireless network (Chapter 2.3).

4. PERIPHERAL PART

The peripheral part of the CP-2080 modules contains 4 binary inputs, 6 relay outputs and 2 transistor outputs.

Table 4.1 shows the wiring of terminals A to D. The wiring of the terminal block C depends on the installed submodules and its variants are given in chapter 4.1.

Tab.4.1 Connection of terminal blocks of basic module CP-2090

A1	TCL2+	TCL2 system bus
A2	TCL2–	TCL2 system bus
A3	GND	ground of the module
A4	+24V	Power supply
A5	CIB+	CIB bus
A6	CIB–	CIB bus
B1	wiring according to mounted submodule 1	
B2		
B3		
B4		
B5	wiring according to mounted submodule 2	
B6		
B7		
B8		
B9	COM1	ground of the submodules

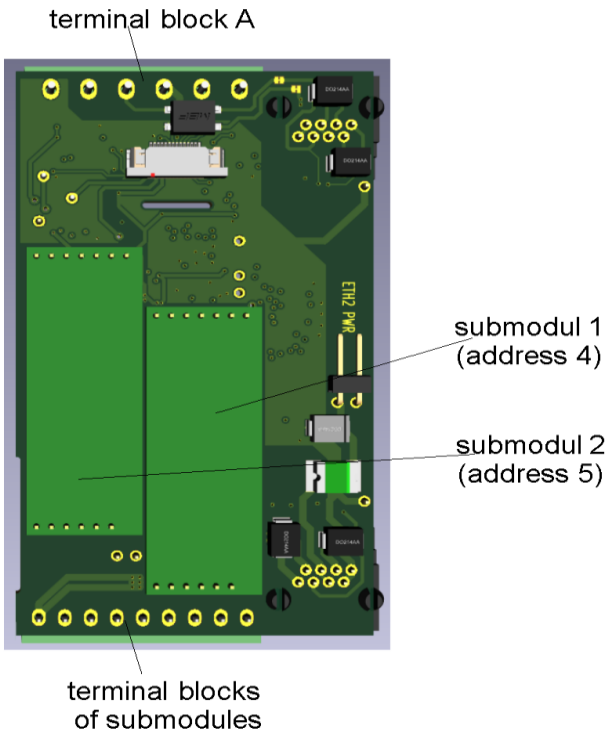
4.1. EXCHANGEABLE SUBMODULES

Exchangeable submodules can contain serial channels or common inputs and outputs. They behave essentially as additional peripheral modules connected directly to the fast internal bus of the base module.

Optional submodules are mounted in the base module CP-2090 on the bottom plate from the outside (area towards the bottom of the module housing) in the positions marked in Pic.4.1.

If the submodule is to be fitted or replaced, use the screwdriver to release the latches on the bottom of the housing. After removing the bottom of the housing, the bottom plate with replaceable submodules is accessible.

ATTENTION!	**The modules contain components sensitive to electrostatic charge, therefore we follow the rules for working with these circuits!** **We only handle the module without power supply!**



Pic.4.1 Placement of replaceable submodules on the base plate of the basic module after removing the bottom of the housing

The sub-modules occupy addresses 4 and 5 on the internal bus. The sub-module with address 4 is located in position 1 and is connected to terminals C1 - C4. The sub-module with address 5 is located in position 2 and is connected to terminals C5 - C8. Both submodules have ground led out to terminal C9 marked COM1. This implies that the galvanically isolated submodules are separate from the internal circuits of the CP-2080 base module, but not from each other.

Tab.4.2 Connection of terminal block C of basic modules CP-2090

B1	wiring according to mounted submodule 1 (adr. 4)	
B2		
B3		
B4		
B5	wiring according to mounted submodule 2 (adr. 5)	
B6		
B7		
B8		
B9	COM1	ground of submodules

4.1.1. Submodules MR-0130 - MR-0134 – serial channels

Serial channel designation in the CH1 - CH10 range is assigned by the user when configuring the user program. This applies both to the serial channels on the submodule and to the other communication channels on the SC-11xx modules connected to the TCL2 bus.

The operation of the serial channels is described in the TECOMAT FOXTROT 2 programmable logic controllers (TXV 004 50.01) documentation.

Tab.4.3 Order numbers and supported exchange submodule modes

Type	Modification	Order number	Supported modes
MR-0130	1x UART interface RS-232 galvanically isolated	TXN 101 30	UNI
MR-0131	1x UART interface RS-485 galvanically isolated	TXN 101 31	
MR-0133	2x UART interface RS-485 galvanically isolated	TXN 101 33	
MR-0134	2x UART interface RS-232 galvanically isolated	TXN 101 34	

RS-232 and RS-485 interface parameters

The MR-0130 - MR-0134 sub-modules contain RS-232 or RS-485 serial channels. The parameters of these interfaces are listed in Table 4.4 and Table 4.5.

Tab.4.4 Technical parameters of the RS-232 interface

Galvanic separation	yes
Isolation voltage of galvanic isolation	1000 V DC
Maximum bit rate	200 kBd
Receiver input resistance	min. 7 kΩ
Output signal level	typ. ± 8 V
Max. length of connected line	15 m

Tab.4.5 Technical parameters of the RS-485 interface

Galvanic separation	yes
Isolation voltage of galvanic isolation	1000 VDC
Maximum bit rate	1 MBd
Receiver sensitivity	min. ± 200 mV
Output signal level	typ. 3 V
Max. length of connected line	1200 m*

* Maximum length applies to twisted and shielded cable and communication speed max. 120 kBd.

For proper operation of the RS-485 communication line it is necessary to terminate it at both ends. On the submodule it is done by flying through the soldering jumper marked BT1 (first channel), resp. BT2 (second channel).

Connection of submodules

Sub-modules contain 1 or 2 serial channels with RS-232 or RS-485 interface depending on the selected variant. Both submodules mounted in the basic PLC module have a common signal ground COM1, which is galvanically separated from the internal PLC circuits.

Tab.4.6 Connection of terminal block C with MR-0130 - MR-0134 submodule

position 1	position 2	MR-0130	MR-0131	MR-0133	MR-0134
addr. 4	addr. 5	1x RS-232	1x RS485	2x RS485	2x RS-232
B1	B5	RxD	TxRx–	TxRx1–	RxD1
B2	B6	TxD	TxRx+	TxRx1+	TxD1
B3	B7	CTS		TxRx2–	RxD2
B4	B8	RTS		TxRx2+	TxD2
B9		COM1	COM1	COM1	COM1

TxD transmitted RS-232 data
RxD received RS-232 data
RTS modem broadcast call (RS-232)

CTS	modem ready for transmission (RS-232)
TxRx–	RS-485 data received and transmitted
TxRx+	RS-485 data received and transmitted
COM1	submodule signal ground

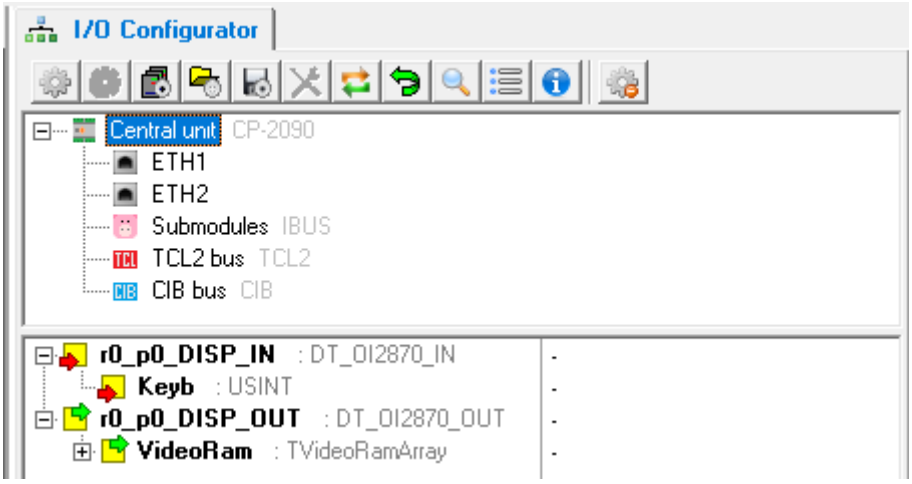
5. USER OPERATION

The peripheral part of the CP-2090 modules contains a binary input and output block, an analog input block and an analog output block. It uses the I / O Configurator to configure these objects. Configuration using this tool is described in the following chapters.

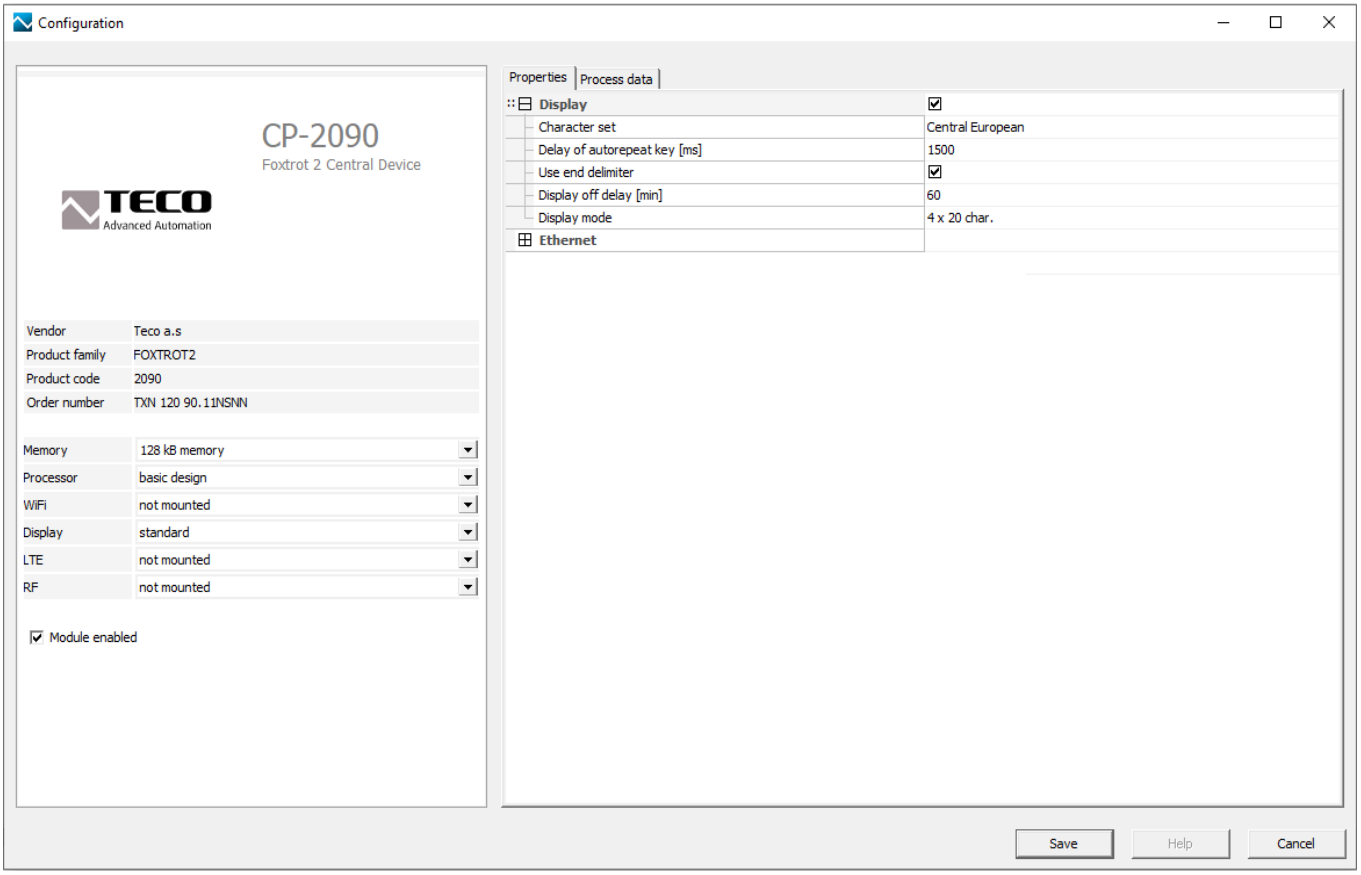
5.1. CONFIGURATION

Open the parameter settings panel in the I / O Configurator window (Pic. 5.1) by double-clicking the Central Unit item in the assembly tree.

If this item was not previously selected by a mouse click, the first click will first show the structure of the variables in the bottom window. Only then does it respond to the double-click that opens the parameter settings window (Pic. 5.2).



Pic.5.1 I/O Configurator tool windows



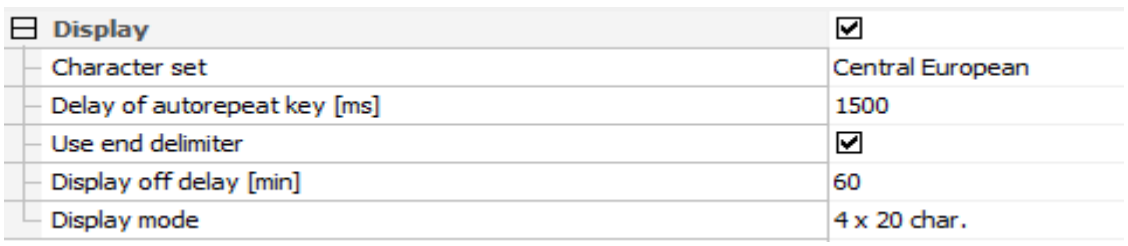
Pic.5.2 CP-2090 module configuration

In the left part of the Configuration panel, in addition to the configured module description, there is the Module enabled item. If checked, the module is operated according to the settings available on the right side of the panel. If the item is unchecked, all module functions set on the right side of the panel are disabled without losing the current settings. This can be used when debugging a user program.

In the right part of the panel there are all the configuration items of the module in the Properties tab. In the Process data tab you can find a list of all variables provided by the module, with the possibility of their own naming (see chapter 5.2).

Integrated display

The integrated display allows characters to be written to the display and user keys read. The display configuration for operation in the user mode is located in the Display node (Fig. 5.10). If the box assigned to this node is unchecked, the display is not in use by the user and operates continuously in system mode. If the box is checked, the display automatically enters the user display mode when the PLC user program is started. It returns to system mode either when the user program execution is stopped (transition to HALT mode or severe error occurs) or after pressing the MODE button on the PLC front panel, which is used to manually switch the display mode.



Pic.5.10 Display configuration

In the Character set item, select the character set according to which the display will decode the displayed ASCII text. There are:

- *Central European* (CP1250)
- *Cyrillic* (CP1251)
- *West European* (CP1252)
- *Greek* (CP1253)

The keypad autorepeat timeout determines the time delay after which the keypad autorepeat is activated when pressed long. a state in which the code of the pressed button is permanently passed until it is released. The autorepeat delay can be set from 0 to 1500 ms, in 100 ms increments. If you want to disable autorepeat, set the delay time to 0.

By checking the Use ending character item, the function passing the ending character (code $ FF) is activated after releasing the button. This function is especially useful when using the autorepeat function and is used to distinguish short and long keystrokes.

Display timeout specifies the time delay since the last key press before the display goes out. The display is reactivated by pressing any button or by switching the PLC to another mode (HALT, RUN), or when a serious PLC error occurs.

In the Display mode item we can select the number of displayed characters on the display in the user mode. Full 4 x 20 characters and reduced 3 x 20 characters are available. Reduced three-line display is used when we want to increase the readability of the displayed characters on a small display due to a larger space between lines.

The behavior and coding of displayed characters and keys are given in chapter 5.3.1.

5.2. DATA PROVIDED

The CP-2090 basic module provides input and output information. The data structure is shown in Table 5.1.

Structure items have symbolic names that always start with r0_p0_. The Full Notation column always lists the specific symbolic name for the item. If we want to use the data in the user program, we either use this symbolic name or we enter our symbolic name in the Alias column, which we can then use. In no case do we use absolute operands, as they may change after a new compilation of the user program.

To create an alias in the I / O Configurator, follow these steps. Double-click the module name in the configuration tree to open the Configuration panel. On the Process data tab, enter the required name in the appropriate row in the Alias column.

Tab.5.1 Data structure

Data structure	Full write	Clamp (signal)	Description of the object
Keyb	r0_p0_DISP_IN.Keyb		code of pressed button
VideoRam[0...79]	r0_p0_DISP_OUT.VideoRam		field of 80 ASCII characters to be displayed

Integrated display input data (r0_p0_DISP_IN)

Keyb - code of pressed button
If no button is pressed, 0 is passed. When the button is pressed, its code (tab.5.7 in chapter 5.3.1.) Is handed over once (in one cycle of the user program). The repeated transmission of the pressed key code is only activated after the autorepeat timeout (if the autorepeat is set). When the button is

released, the so-called $ FF termination character (255) is sent once if the termination character is set.

Integrated display output data (r0_p0_DISP_OUT)

VideoRam - field of 80 ASCII characters to be displayed
The display processor first decodes the received text according to the set character set, and then displays the corresponding characters on the display.

The behavior of individual data objects is described in chapter 5.3.

5.3. BEHAVIOR OF INDIVIDUAL DATA OBJECTS

The peripheral part of CP-2090 modules contains the following data objects:

• integrated display (chap. 5.3.1.)

5.3.1. Integrated display

The CP-2090 features an integrated 4 x 20 character OLED display and 6 user buttons.

The display is active 60 minutes from the start of the user program or the last press of any button. Then it goes out. Activate it for another 60 minutes by pressing any button or by switching the PLC to another mode (HALT, RUN). The display is also activated when a serious PLC fault occurs.

The time of 60 minutes is the default value and can be changed within the display configuration in the user program (chapter 5.1.).

Display character set

The display serves both for displaying system information and for application use by the user as a conventional operating panel. If the display is operated by the user program, then in the RUN mode, it operates in the user mode. it displays characters generated by the user program. With the MODE button, it can be switched to the system mode to display the system status. The behavior of the display in system mode is described in the TECOMAT FOXTROT 2 programmable logic controllers (TXV 004 50.01) documentation.

The display is operated in character mode. Allows you to display the 256 characters of the character set selected when the user program was initialized. The following Windows character sets are available:

CP1250 (WinLatin2 - Central European)
CP1251 (WinCyrillic - Cyrillic)
CP1252 (WinLatin1 - West European)
CP1253 (WinGreek - Greek)

All of these character sets have the same encoding of the first 128 characters. Codes 0-31 contain graphical characters for creating lines and bargraphs and displaying key characters. Codes 32 - 127 correspond to standard ASCII encoding. Codes 128 - 255 vary according to the selected code page and contain national alphabet characters and other characters.

Individual characters and their encoding are listed in the following tables.

Tab.5.2 ASCII character code table 0 - 127 ($ 00 - $ 7F)

code	$0x	$1x	$2x	$3x	$4x	$5x	$6x	$7x
$x0		│		0	@	P	`	p
$x1	▔	┤	!	1	A	Q	a	q
$x2	▔	┐	“	2	B	R	b	r
$x3	▁	└	#	3	C	S	c	s
$x4	▁	┴	$	4	D	T	d	t
$x5	▁	┬	%	5	E	U	e	u
$x6	▁	├	&	6	F	V	f	v
$x7	▁	─	’	7	G	W	g	w
$x8	▁	↑	(	8	H	X	h	x
$x9	▁	↓	)	9	I	Y	i	y
$xA	▁	→	*	:	J	Z	j	z
$xB	▁	←	+	;	K	[	k	{
$xC	▁	┼	,	<	L	\	l	|
$xD	✓	┘	–	=	M	]	m	}
$xE	-1	┌	.	>	N	^	n	~
$xF	∞		/	?	O	_	o	■

Tab.5.3 ASCII character code table 128 - 255 ($ 80 - $ FF) for code page CP1250 (Central European)

code	$8x	$9x	$Ax	$Bx	$Cx	$Dx	$Ex	$Fx
$x0	€			°	Ŕ	Đ	ŕ	đ
$x1		‘		±	Á	Ń	á	ń
$x2	‚	‘			Â	Ň	â	ň
$x3		“	Ł	ł	Ă	Ó	ă	ó
$x4	„	“	¤		Ä	Ô	ä	ô
$x5	…	•	Ą	µ	Ĺ	Ő	Í	ő
$x6	†	-	¦	¶	Ć	Ö	ć	ö
$x7	‡	–	§	·	Ç	x	ç	÷
$x8	^	~			Č	Ř	č	ř
$x9	‰			ą	É	Ů	é	ů
$xA	Š	š	Ş	ş	Ę	Ú	ę	ú
$xB	<	>	«	»	Ë	Ű	ë	ű
$xC	Ś	ś	¬	Ľ	Ě	Ü	ě	ü
$xD	Ť	ť	–		Í	Ý	í	ý
$xE	Ž	ž		ľ	Î	Ţ	î	ţ
$xF	Ź	ź	Ż	ż	Ď	ß	ď	■

Tab.5.4 ASCII code table of characters 128 - 255 ($ 80 - $ FF) for code page CP1251 (Cyrillic)

code	$8x	$9x	$Ax	$Bx	$Cx	$Dx	$Ex	$Fx
$x0	Ђ	ђ		°	А	Р	а	р
$x1	Ѓ	‘	Ў	±	Б	С	б	с
$x2	‚	‘	ў	І	В	Т	в	т
$x3	ѓ	“	Ј	і	Г	У	г	у
$x4	„	“	¤	ґ	Д	Ф	д	ф
$x5	…	•	Ґ	µ	Е	Х	е	х
$x6	†	-	¦	¶	Ж	Ц	ж	ц
$x7	‡	–	§	·	З	Ч	з	ч
$x8	€		Ё	ё	И	Ш	и	ш
$x9	‰			№	Й	Щ	й	щ
$xA	Љ	љ	Є	є	К	Ъ	к	ъ
$xB	<	>	«	»	Л	Ы	л	ы
$xC	Њ	њ	¬	j	М	Ь	м	ь
$xD	Ќ	ќ	–	S	Н	Э	н	э
$xE	Ћ	ћ		s	О	Ю	о	ю
$xF	Џ	џ	Ї	ї	П	Я	п	я

Tab.5.5 ASCII character code table 128 - 255 ($ 80 - $ FF) for code page CP1252 (Western European)

code	$8x	$9x	$Ax	$Bx	$Cx	$Dx	$Ex	$Fx
$x0	€			°	À	Ð	à	ð
$x1		‘	¡	±	Á	Ñ	á	ñ
$x2	‚	‘	¢	²	Â	Ò	â	ò
$x3	*ƒ*	“	£	³	Ã	Ó	ã	ó
$x4	„	“	¤		Ä	Ô	ä	ô
$x5	…	•	¥	µ	Å	Õ	å	õ
$x6	†	–	¦	¶	Æ	Ö	æ	ö
$x7	‡	–	§	·	Ç	x	ç	÷
$x8	^	~			È	Ø	è	ø
$x9	‰			¹	É	Ù	é	ù
$xA	Š	š	ª	º	Ê	Ú	ê	ú
$xB	<	>	«	»	Ë	Û	ë	û
$xC	Œ	œ	¬	¼	Ì	Ü	ì	ü
$xD			–	½	Í	Ý	í	ý
$xE	Ž	ž		¾	Î	Þ	î	þ
$xF		Ÿ	¯	¿	Ï	ß	ï	ÿ

Tab.5.6 ASCII character code table 128 - 255 ($ 80 - $ FF) for code page CP1253 (Greek)

code	$8x	$9x	$Ax	$Bx	$Cx	$Dx	$Ex	$Fx
$x0	€			°	ΐ	Π	ΰ	π
$x1		‘		±	Α	Ρ	α	ρ
$x2	‚	‘	Ά	²	Β		β	ς
$x3	ƒ	“	£	³	Γ	Σ	γ	σ
$x4	„	“	¤		Δ	Τ	δ	τ
$x5	…	•	¥	µ	Ε	Υ	ε	υ
$x6	†	–	¦	¶	Ζ	Φ	ζ	φ
$x7	‡	–	§	·	Η	Χ	η	χ
$x8	^	~		Έ	Θ	Ψ	θ	ψ
$x9	‰			Ή	Ι	Ω	ι	ω
$xA				Ί	Κ	Ϊ	κ	ϊ
$xB	<	>	«	»	Λ	Ϋ	λ	ϋ
$xC			¬	Ό	Μ	ά	μ	ό
$xD			–	½	Ν	έ	ν	ύ
$xE				Ύ	Ξ	ή	ξ	ώ
$xF			―	Ώ	Ο	ί	ο	■

Button coding

There are 6 buttons marked with cursor arrows, ✓ (enter) and **X** (cancel) for use in the application. These buttons are coded according to table 5.8. The system supports the autorepeat function (periodic transmission of the button code when pressed for a long time) and the possibility to switch on the transmission of the so-called terminating character generated by releasing the pressed button.

Tab.5.7 Button coding

code	button
$00	no button is pressed
$0D	✓
$18	△
$19	▽
$1A	▷
$1B	◁
$7F	**X**
$FF	Exit character (released button pressed)

The MODE button is used to switch the display between system and user display modes and cannot be used for the application. Conversely, in system display mode, the buttons indicated by the cursor arrows are used to scroll through the system screens. The key pressed codes are not transmitted to the PLC scratchpad in system mode.

Teco, a.s., Průmyslová zóna Šťáralka 984, 280 02 Kolín, tel. 321 401 111

TXV 004 53.02