

X90DI110.10-00

1 General information

The modular X90 mobile control and I/O system opens up a wide range of possibilities in mobile automation. With the X90 mobile system, flexible automation concepts can be implemented based on a standardized complete system.

Option board X90DI110.10-00 is integrated in the X90 mobile system and extends the functionality of the entire system.

The DI option board offers 10 additional digital inputs that can be configured as 6.5 / 9 / 18 kΩ sink or source inputs. Communication to the mainboard is made possible via X2X Link.

- 9 to 32 VDC
- 10 digital inputs
- Sink or source circuit
- Counter inputs 50 kHz
- AB encoders
- X2X Link

2 Order data

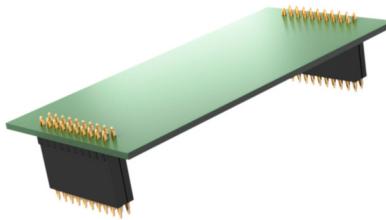
Order number	Short description	Figure
X90DI110.10-00	Digital inputs X90 mobile option board DI, 10 digital inputs, 9 to 32 VDC, optional sink/source, optional counter input 50 kHz or AB encoder, configuration using software	

Table 1: X90DI110.10-00 - Order data

Inputs and outputs - Overview

X90DI110.10-00		Output				Input			
Multifunction I/O	Quantity	PWM	Digital	Analog	PWM signal	Temperature	Analog	Counter functionality	Digital
MF-DI	10							X	X

3 Technical data

Order number	X90DI110.10-00
Short description	
I/O module	10 digital inputs 9 to 32 VDC for 1-wire connections
General information	
B&R ID code	0xEBC1
Status indicators	-
Power consumption	0.37 W
Electrical isolation	
Digital - Digital	No
Certifications	
UN ECE-R10	Yes
CE	Yes
Multi-function inputs	
Multifunction digital inputs (MF-DI)	
Quantity	10
Functions	Digital input, sink/source circuit - configurable per channel, configurable software input filter, counter input with 50 kHz counter frequency, gate measurement, AB encoder
Digital inputs	
Quantity	10
Input voltage	9 to 32 VDC
Input current at 24 VDC	Typ. 1.2 / 2.5 / 3.6 mA, configurable using software
Input circuit	Sink/Source, configurable
Input filter	
Hardware	3 µs
Software	Default 1 ms, configurable between 0 and 25 ms in 0.1 ms increments
Input resistance	Typ. 6.5 / 9 / 18 kΩ, configurable
Switching threshold	50% supply voltage
Operating conditions	
Mounting orientation	
Any	Yes
Degree of protection per EN 60529	Up to IP69K ¹⁾
Ambient conditions	
Temperature	
Operation	
Horizontal mounting orientation	-40 to 85°C housing surface ¹⁾
Vertical mounting orientation	-40 to 85°C housing surface ¹⁾
Storage	-40 to 85°C
Transport	-40 to 85°C
Relative humidity	
Operation	5 to 100%, condensing
Storage	5 to 100%, condensing
Transport	5 to 100%, condensing
Mechanical properties	
Dimensions	
Width	47 mm
Length	95 mm

Table 2: X90DI110.10-00 - Technical data

1) Depends on the mainboard. For additional details, see the data sheet for the mainboard.

4 Operating and connection elements

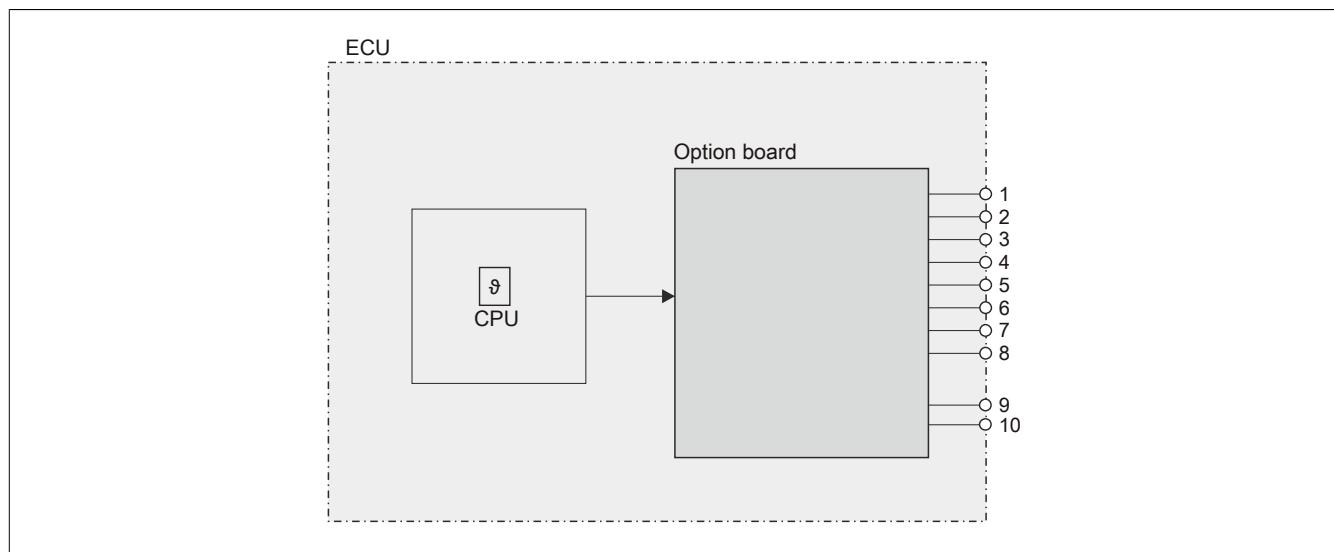
4.1 X2X Link interface

Communication between the option board and mainboard is implemented using X2X Link.

5 Pinout

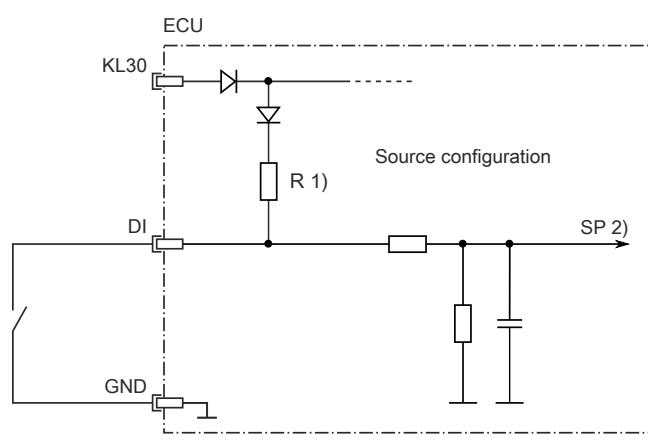
Channel	Pinout
1	MF-DI
2	MF-DI
3	MF-DI
4	MF-DI
5	MF-DI
6	MF-DI
7	MF-DI
8	MF-DI
9	MF-DI
10	MF-DI

6 Block diagram



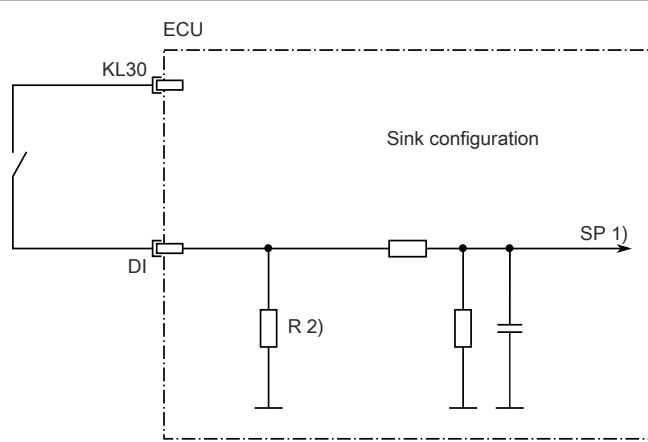
6.1 Input circuit diagram

Digital input, negative switching



- 1) 6.9 / 10 / 22 kΩ resistance according to the configuration
- 2) Signal processing

Digital input, positive switching



- 1) Signal processing
- 2) 6.9 / 10 / 22 kΩ resistance according to the configuration

7 Register description

7.1 System requirements

The following minimum versions are recommended to generally be able to use all functions:

- Automation Studio 4.3
- Automation Runtime 4.3

7.2 Overview of registers

Register	Name	Data type	Read		Write	
			Cyclic	Acyclic	Cyclic	Acyclic
Communication - Digital inputs						
2	Input state of the digital inputs	UINT	•			
	DigitalInput01	Bit 0				
				
	DigitalInput10	Bit 9				
Communication - Counter						
6 + (N-1) * 4	Event/PeriodCounterN (index N = 01 to 10)	UINT	•			
Communication - AB encoder						
6 + (N-1) * 8	EncoderN (index N = 01 to 05)	INT	•			
45 + (N-1) * 2	ErrorCountEncoder(index N = 01 to 05)	USINT	•			
Communication - Reset counter						
2	Resetting counters or AB encoders	UINT	•			
	ResetCounter01	Bit 0				
	ResetEncoder01					
	ResetCounter02	Bit 1				
	ResetCounter03	Bit 2				
	ResetEncoder02					
	ResetCounter04	Bit 3				
	ResetCounter05	Bit 4				
	ResetEncoder03					
	ResetCounter06	Bit 5				
	ResetCounter07	Bit 6				
	ResetEncoder04					
Configuration - Filter time of digital inputs						
1025 + (N-1) * 2	cfgDigitalFilterN (index N = 01 to 10)	USINT				•
Configuration - Pin configuration						
1045 + (N-1) * 2	cfgPinModeN (index N = 01 to 10)	USINT				•
Configuration - Counter configuration						
1066 + (N-1) * 4	cfgCounterModeN (index N = 01 to 10)	UINT				•
Configuration - Counter timeout						
1106 * (N-1) * 4	cfgCounterTimeoutN (index N = 01 to 10)	UINT				•

7.3 Physical configuration of I/O channels

These registers define the function of the channels. Depending on the desired configuration, the following assignments can be made with respect to the existing software and hardware:

- One physical configuration as sink or source input
- Definition of the input resistance

7.3.1 Physical configuration

Name:

cfgPinMode01 to cfgPinMode10

These registers configure the function of the channels.

Data type	Values	
USINT	See the bit structure.	
Data type	Values	Information
USINT	30	Digital input source 6.5 kΩ
	31	Digital input source 9 kΩ
	32	Digital input source 18 kΩ
	40	Digital input sink 6.5 kΩ
	41	Digital input sink 9 kΩ
	42	Digital input sink 18 kΩ

7.3.2 Digital input filter

Name:

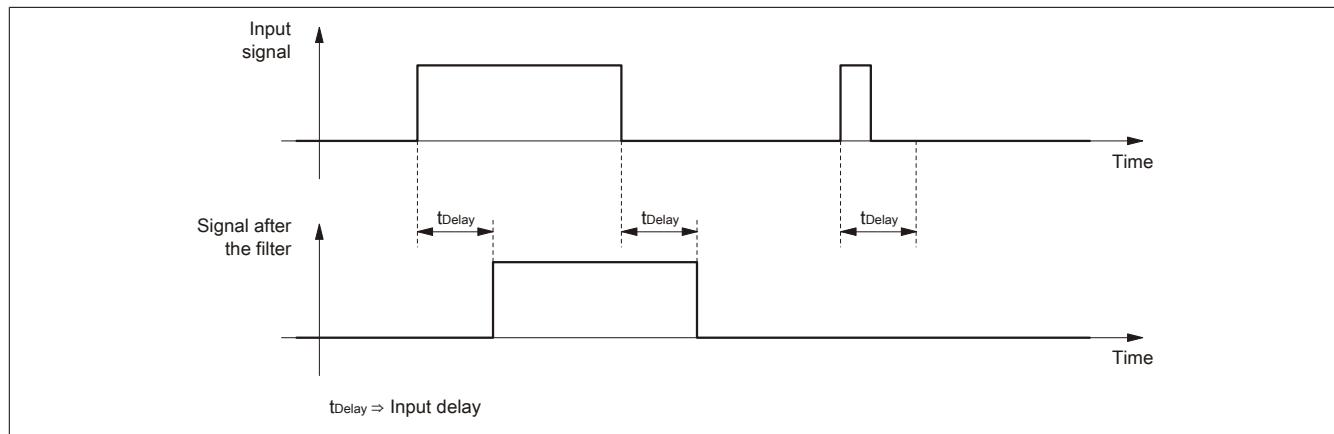
cfgDigitalFilter01 to cfgDigitalFilter10

Information:

The digital input filter is not used with the counter functions.

This register can be used to specify the filter value for all digital inputs in steps of 100 µs. The filter is implemented as a ramp filter.

Data type	Values	Information
USINT	0	No software filter
	1	0.1 ms
...	...	
	10	1 ms (default)
...	...	
	250	25.5 ms



7.3.3 Counter configuration

Name:
cfgCounterMode01 to cfgCounterMode10

The functionality of the counters can be configured with these registers.

Example

Set prescaler: 12.5 MHz
Displayed counter value: 2500

Frequency: $12.5 \text{ MHz} / 2500 = 5 \text{ kHz}$
Period duration: $1 / 5 \text{ kHz} = 200 \mu\text{s}$

AB encoders

For each AB encoder, 2 digital inputs are permanently assigned and must be configured accordingly as AB encoders. The following table shows the assignment of the digital inputs to the respective AB encoders:

Encoder	Digital inputs
1	1 and 2
2	3 and 4
3	5 and 6
4	7 and 8
5	9 and 10

Information:

The AB signals are sampled and evaluated cyclically every 50 µs. For correct evaluation, a maximum of 1 edge change is permitted to occur on the encoder inputs during this time.

Data type	Values
UINT	See the bit structure.

Bit structure:

Bit	Description	Value	Information
0 to 3	Counter module of counter x	0000	Off
		0001	Edge counters
		0010	Period measurement
		0011	AB encoder
4 to 5	Edge detection	00	Falling edges are counted.
		01	Rising edges are counted.
		10	All edges are counted.
8 to 12	Prescaler (only for period measurement)	00000	50 MHz
		00001	25 MHz
		00010	12.5 MHz
		00011	6.25 MHz
		00100	3.125 MHz
		00101	1.5625 MHz
		00110	7881.25 kHz
		00111	390.625 kHz
		01000	195.312 kHz
		01001	97.656 kHz
		01010	48.828 kHz
		01011	24.414 kHz
		01100	6.103 kHz
		01101	3.051 kHz
		01110	1.525 kHz
		10000	763 Hz

7.3.4 Counter timeout

Name:
cfgCounterTimeout01 to cfgCounterTimeout10

A timeout for period measurement is set in these registers. If an edge is not detected in the specified time frame, the corresponding counter is set to 0.

Data type	Values
UINT	See the bit structure.

Bit structure:

Bit	Values	Information
0 to 15	10 to 50,000	Timeout time for counter x (1 ms to 5 s, 1 LSB = 100 µs)

7.4 Digital inputs

This module is equipped with 10 digital inputs for 1-wire connections. The inputs of the module are designed for sink and source circuits.

Topics in this section:

- Filter time
- Input values of the digital inputs

Input impedance is tightly defined by the physical configuration.

7.4.1 Input state of the digital inputs

Name:
DigitalInput01 to DigitalInput10

The input state of digital inputs 1 to 10 is mapped in this register.

Data type	Values
UINT	See the bit structure.

Bit structure:

Bit	Description	Value	Information
0	DigitalInput01	0 or 1	Input status of digital input 1
...
9	DigitalInput10	0 or 1	Input status of digital input 10

7.5 Counters and encoders

7.5.1 Period/Event counters and AB encoders

Name:
EventCounter01 to EventCounter10
PeriodCounter01 to PeriodCounter10
Encoder01 to Encoder05

Depending on the configuration, these registers indicate the current value of the edge counter, period measurement or AB encoder.

The edge counter starts at 0 again on overflow.

Information:

The measured value for period measurement depends on the set prescaler (see "Counter configuration" on page 7).

Data type	Values	Information
UINT	0 to 65,535	Edge counter and period measurement
INT	-32768 to 32767	AB encoders

7.5.2 Resetting counters or AB encoders

Name:

ResetCounter01 to ResetCounter10

ResetEncoder01 to ResetEncoder05

The value of the counter or AB encoder can be reset in these registers.

Data type	Values
UINT	See the bit structure.

Bit structure:

Bit	Description	Value	Information
0	ResetCounter01 ResetEncoder01	0	No action
		1	Resets the counter or encoder value
1	ResetCounter02	0	No action
		1	Reset counter value
2	ResetCounter03 ResetEncoder02	0	No action
		1	Resets the counter or encoder value
3	ResetCounter04	0	No action
		1	Reset counter value
4	ResetCounter05 ResetEncoder03	0	No action
		1	Resets the counter or encoder value
5	ResetCounter06	0	No action
		1	Reset counter value
6	ResetCounter07 ResetEncoder04	0	No action
		1	Resets the counter or encoder value
7	ResetCounter08	0	No action
		1	Reset counter value
8	ResetCounter09 ResetEncoder05	0	No action
		1	Resets the counter or encoder value
9	ResetCounter10	0	No action
		1	Reset counter value

7.5.3 AB error counter

Name:

ErrorCountEncoder01 to ErrorCountEncoder05

The errors that occur for the respective AB encoder are output in these registers. An error is detected if more than one edge change occurs on the AB encoder inputs during a sampling cycle.

Data type	Values
USINT	0 to 255