MINC-2

Technical Documentation
ICI (Incremental Counter Interface) Submodule

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Revision History

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MINC 2 ISI Submodule (Incremental Counter Interface)

24-Bit Resolution

1 General

The MINC-2 input module is a submodule, which is galvanically decoupled by means of optocouplers, for the FOX-20 basic module. The submodule provides two incremental counters.
For operation in the II/O system, you can install up to four MINC-2s in the four slots of a FOX-20 basic module. This makes possible a maximum of 8 incremental inputs per FOX-20. In addition, you can combine MINC-2s with different modules, e.g. digital outputs.

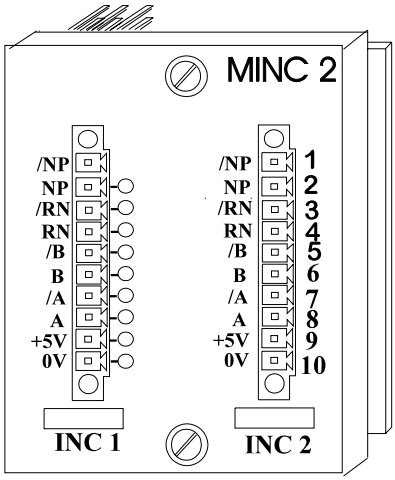


Figure: Two-Channel INC-2 Module

2 Technical data of MINC-2

Inputs	Two incremental counter inputs Reference cams galvanically decoupled
Input Level	Input voltage RS-422
Resolution	24-bit counter (twos complement)
Encoder Feed	+5 V DC
Current Consumption	0.1 A (without encoder)
Housing	Module with front panel is mounted in the FOX-10 using two screws.
Dimensions (W x H x D)	58 x 72 x 50 mm, Weight 100 g
Temperature	Operation: ±0..+55° C, Storage: -20..+70° C

3 Signal description and example of MINC-2 connection

Pin	**Signal**	**I/O**	**Description of Channel 1**
L-1	/NP		Inv. zero pulse
L-2	NP		Zero pulse
L-3	RN-		Inv. reference cam
L-4	RN+		Reference cam
L-5	/B		Inv. channel B
L-6	B		Channel B
L-7	/A		Inv. channel A
L-8	A		Channel A
L-9	+5V	Supply	Supply voltage for the encoder
L-10	0 V	Ground	
Pin	**Signal**	**I/O**	**Description of Channel 2**
R-1	/NP		Inv. zero pulse
R-2	NP		Zero pulse
R-3	RN-		Inv. reference cam
R-4	RN+		Reference cam
R-5	/B		Inv. channel B
R-6	B		Channel B
R-7	/A		Inv. channel A
R-8	A		Channel A
R-9	+24V	Supply	Supply voltage for the encoder
R-10	0 V	Ground	

Pin designations: L: left-hand row
R: right-hand row

4 Message traffic to the FOX-20 when reading the incremental channels

4.1 Message structure for FOX-20

FOX-20 allows you to use all the possible digital and analog submodules, as well as incremental counter modules, for example. In this case, there are only 16 bits of user data in the FOX-20 message. Data byte DB0 is for addressing the slot and the word no./channel no. within a slot; data byte DB1 is for future expansion and currently always contains the value 80 hex. The 16 bits of user data are transferred in data bytes DB2 and DB3.

If the MINC-2 needs only 16 bits of encoder data, this can be carried out using one message.

16-bit resolution:
Every access of the counter is carried out by one (1) message.

If, on the other hand, all 24 bits of the counter are used, two additional messages are needed. The first message interrupts the update of the counter. It is now possible to completely read out one counter with two subsequent messages. The last message reenables the updates for the module.

The system carries out accessing of the counter by means of two (2) messages to disable the update and to enable the updates as well as two (2) messages per counter to load the encoder position.

The FOX code (30 hex) is used as the control byte in the FOX-20 (30 hex means FOX-20 message).
The FOX-20-internal slot/Word/channel address is specified in data byte DB0 of the message.

DB0 is divided into two:

The top nibble contains the number of the submodule. The first submodule that is plugged in to the left-hand slot of the FOX-20 basic module is given submodule number 1.
From right to left, the possible numbers read 1, 2, 3 and 4.

The bottom nibble defines the channel of the submodule. Example: incremental counter channel 1 is given channel number 1, incremental counter channel 2 is given channel number 2. The top nibble defines the word address of the slot. Incremental counter 1 occupies word 1 and word 2, incremental counter 2 occupies word 3 and word 4.

The actual user information is in DB2 and DB3.

At 16-bit resolution, DB2 contains the low byte and DB3 the high one.

At 24-bit resolution, DB2 contains the first message and the low byte, DB3 contains the middle byte; in the second message, DB2 contains the high byte.

At 25-bit resolution, DB3 of the second message contains bit 2^24.

4.2 Messages for MINC-2 in FOX-20

ADR	= Module address	= 1 .. 254 dec
ContrlByte	= Read/Write FOX-20	= 30 hex
DB0	= Channel-Select	= HighNibble := SubmoduleSlot 1..4 LowNibble := WordNumber 1,2,3,4,5,6,7,8 and 15
DB1	= Must be 80 hex	
DB2	= LSB data	
DB3	= MSB data	

4.3 Examples of FOX-20 messages:

Example 1:

Two MINC-2 submodules with two channels each are plugged in the FOX-20. All four (4) counter values are to be read out. The counters supply 24- (25-) bit resolution.

The first message tells the FOX-20 basic module that the counters are to be latched on all 24 bits, and that it is not to carry out any more updates until enabling. Stopping updating is achieved by writing a 1 in DB 2 on slot no. 0, word address 15:

Address	ControlByte	DB	0	DB 1	DB 2	DB 3
Address	ControlByte	Slot	Word	Fixed 80 hex	Low Byte	High Byte
e.g. **1** (Box 1)	**0011 0000**	**0000**	**1111**	**1000 0000**	**0000 0001**	xxxx xxxx

The second message reads in the least-significant word of the first counter (slot 1, word/channel 1):

Address	ControlByte	DB	0	DB 1	DB 2	DB 3
Address	ControlByte	Slot	Word	Fixed 80 hex	Low Byte	High Byte
e.g. **1** (Box 1)	**0011 0000**	**0001**	**0001**	**1000 0000**	0011 1100	0100 0000

The third message reads in the most-significant word of the first counter (slot 1, word/channel 2):

Address	ControlByte	DB	0	DB 1	DB 2	DB 3
Address	ControlByte	Slot	Word	Fixed 80 hex	Low Byte	High Byte
e.g. **1** (Box 1)	**0011 0000**	**0001**	**0010**	**1000 0000**	0000 0001	0111 1111

The fourth message reads in the least-significant word of the second counter (slot 1, word/channel 3):

Address	ControlByte	DB	0	DB 1	DB 2	DB 3
Address	ControlByte	Slot	Word	Fixed 80 hex	Low Byte	High Byte
e.g. **1** (Box 1)	**0011 0000**	**0001**	**0011**	**1000 0000**	0101 1010	1111 0011

The fifth message reads in the most-significant word of the second counter (slot 1, word/channel 4):

Address	ControlByte	DB	0	DB 1	DB 2	DB 3
Address	ControlByte	Slot	Word	Fixed 80 hex	Low Byte	High Byte
e.g. **1** (Box 1)	**0011 0000**	**0001**	**0100**	**1000 0000**	0000 0000	0000 1111

The sixth message reenables the module the system updates the counters again.
Write a 0 in DB 2 on slot 0, word/channel 15

Address	ControlByte	DB	0	DB 1	DB 2	DB 3
Address	ControlByte	Slot	Word	Fixed 80 hex	Low Byte	High Byte
e.g. **1** (Box 1)	**0011 0000**	**0000**	**1111**	**1000 0000**	**0000 0000**	xxxx xxxx

The read-out counter value of encoder 1 is:

(Bit 25 .... Bit 0) 1 0111 1111 0011 1100 0100 000

The read-out counter value of encoder 2 is:

(Bit 25 .... Bit 0) 0 0000 1111 0101 1010 1111 0011

Example 2:

One MINC-2 submodule with two channels is plugged in the FOX-20. One counter value is to be read out. The sixteen-bit resolution is adequate, since a linear absolute encoder, for example, is used.

Access to slot 1/counter 1, 16-bit resolution

Encoder Position = 0100 0000 0011 1100

Address	ControlByte	DB	0	DB 1	DB 2	DB 3
Address	ControlByte	Slot	Word	Fixed 80 hex	Low Byte	High Byte
e.g. **1** (Box 1)	**0011 0000**	**0001**	**0001**	**1000 0000**	0011 1100	0100 0000

5 FOX 20 with lightbus-connection

5.1 FOX-20 incremental interface

The Fox-20 incremental module has 2 channels for incremental encoders. Each of these channels has an input for a reference switch. The function of the module and the placement in the DPRAM of the data are described in the following.

5.1.1 1. DPRAM:

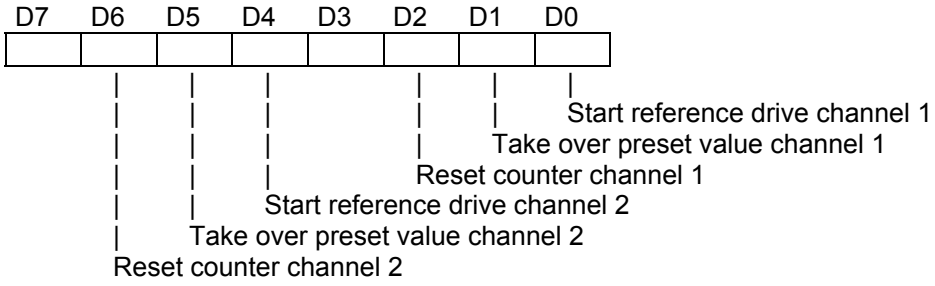
In the FOX-20 box up to 4 modules can be plugged. The address range for every module is 16 words. The addresses for the incremental module consist of the number of the slot place and the channel number:

	Slot place (High Nibble)	Channel No. (Low Nibble)	Address	
Module 1	0001H	0001H	11H	Actual value + Preset Channel 1 Low Word
	0001H	0010H	12H	Actual value + Preset Channel 1 High Word
	0001H	0011H	13H	Actual value + Preset Channel 2 Low Word
	0001H	0100H	14H	Actual value + Preset Channel 2 High Word
	0001H	0101H	15H	Status Word
Module 2	0010H	0001H	21H	Actual value + Preset Channel 1 Low Word
	0010H	0010H	22H	Actual value + Preset Channel 1 High Word
	0010H	0011H	23H	Actual value + Preset Channel 2 Low Word
	0010H	0100H	24H	Actual value + Preset Channel 2 High Word
	0010H	0101H	25H	Status Word
Module 3	0011H	0001H	31H	Actual value + Preset Channel 1 Low Word
	0011H	0010H	32H	Actual value + Preset Channel 1 High Word
	0011H	0011H	33H	Actual value + Preset Channel 2 Low Word
	0011H	0100H	34H	Actual value + Preset Channel 2 High Word
	0011H	0101H	35H	Status Word
Module 4	0100H	0001H	41H	Actual value + Preset Channel 1 Low Word
	0100H	0010H	42H	Actual value + Preset Channel 1 High Word
	0100H	0011H	43H	Actual value + Preset Channel 2 Low Word
	0100H	0100H	44H	Actual value + Preset Channel 2 High Word
	0100H	0101H	45H	Status Word

The data transfer via the lightbus ring to the DPRAM is bidirectional. That means, that the same address which is transferred in the lightbus-telegram to address the DPRAM, is also used for writing of a preset-value and reading of the actual-value. The same applies to the status word.

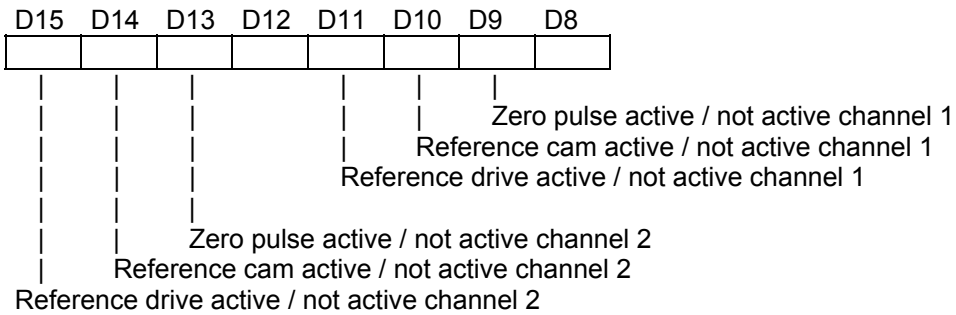
5.1.2 2. STATUS WORD:

Low Byte (read/write):



The low byte of the status word can be written and read. For example, if the reference drive for channel 1 is started, the bit D0 must be set. If you reading-back the status word and the bit D0 is set, the reference-drive for channel 1 has been started. To be able to execute further reference drives, after receipt of this acknowledgment the bit D0 must be reset. After this, the module also resets his acknowledgment.

High Byte (read):



The high byte of the status word can be read only and displays the status of the incremental interface.

5.1.3 3. Starting reference drive:

1. Set the bit "Start reference drive channel 1 or channel 2" and send the lightbus telegram to the FOX-20.

2. Reading back the status word, until the FOX-20 box has acknowledged the starting of the reference drive in bit D0 for channel 1 or bit D4 for channel 2.

3. Reset the bit "Start reference drive channel 1 or channel 2" and send the lightbus telegram to the FOX-20.

4. In the high byte of the status word via the bit D11 for channel 1 and bit D15 for channel can be established whether the incremental interface has recognized the starting of the reference drive.

5. If the reference drive will be carried out and the reference cam is recognized, the reference drive is continued as long as the zero-pulse of the encoder is recognized. By recognition of the zero-pulse, the bit "Reference drive active" in the high byte of the status word will be reset (D11 or D15). Reaching the zero-pulse also can be read back in the status word.

6. If the reference drive is finished, the counter of the incremental interface is set to "0". In addition, a preset value transmitted before is deleted so that a execution of a new preset can be necessary.

5.1.4 4. Submitting of the PRESET VALUE:

1. Transmit the preset value for channel 1 or channel 2 via a lightbus telegram to the FOX-20. It must be sent two telegrams, because per telegram only 1 data word can be transferred.

2. Send a lightbus telegram to the FOX-20 by setting the bit "Take over preset value channel 1 or channel 2" in the low byte of the status word.

3 Reading back the status word, until the FOX-20 box has acknowledged the taking over of the preset value in bit D1 for channel 1 or bit D5 for channel 2.

4 Reset the bit "Take over preset value channel 1 or channel 2" and send the lightbus telegram to the FOX-20.