

Official UK & Ireland Distributor

EncoderSSI - FCT640 Application note

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1. Italiano	1
1.1. Introduzione	
1.2. Impostazione "Encoder Type" e "Total Steps of Absolute Encoder" .	2
1.3. Reset della Quota Encoder	4
1.4. Cattura Quota	
1.5. Variabili per il Reset dei fault	6
1.6. Configurazione via CANopen	6
1.7. Risoluzione dei problemi	10
2. English	12
2.1. Introduction	12
2.2. Setting of "Encoder Type" and "Total Steps of Absolute Encoder"	12
2.3. Encoder Position Reset	
2.4. Position Capture	15
2.5. Variables for the fault Reset	
2.6. Configuration via CANopen	17
2.7. Troubleshooting	21

1. Italiano

1.1. Introduzione

SISTEMI ELETTRONICI

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Questa application note ha lo scopo di guidare l'utente alla configurazione di un modulo TB20 SSI con un controllore FCT640, riportando un esempio di utilizzo. Si consiglia di conservare questo documento assieme al prodotto. Per informazioni più complete riguardo al modulo o al controllore, fare riferimento ai documenti disponibili nel sito http://www.cmz.it o rivolgersi a CMZ SISTEMI ELETTRONICI S.r.l..

L'esempio riportato nel presente documento consiste nel collegare un Encoder SSI dell'Eltra con codifica Gray a 13bit (8192 impulsi di onda primaria) al Modulo 640-320-7AA01 e provare le varie funzionalità previste dal modulo sul:

- 1. HBUS del FCT640
- 2. Coupler EtherCAT

3. Coupler CANopen

1.2. Impostazione "Encoder Type" e "Total Steps of Absolute Encoder"

L'impostazione del tipo di encoder sembra non funzionare in quanto l'unica configurazione ammissibile è "SSI 15 bit" (configurazione di Default).

Se imposto il tipo di encoder a "SSI 13 bit", il led rosso del modulo lampeggia Rosso "parameter assignment error".

Causa: la non coerenza tra impostazione Encoder "SSI 13 bits" e il parametro "Total steps of Absolute Encoder"

🖃 🖓 🚰 General				
🖤 🖗 Diagnostic alarm	BOOL	TRUE	FALSE	
🖤 🖗 Gray-/Dual Converter	Enumeration of USINT	Gray	Gray	
Encoder type	Enumeration of USINT	SSI 13 Bits 🛛 🗸	SSI 15 Bits	
Total steps of absolut encoder	UDINT(162147483648)	SSI 8 Bits	32768	
Number of trailing bits	USINT(015)	SSI 9 Bits SSI 10 Bits	0	
🖤 🖗 Parity	Enumeration of USINT	SSI 11 Bits	None	
🖤 < Repetition	Enumeration of USINT	SSI 12 Bits	Inactive	
🖤 🖗 Baud rate	Enumeration of USINT	SSI 14 Bits	125 kHz	
Monoflop time	Enumeration of USINT	SSI 15 Bits	32 µs	
Comparator 1	Enumeration of USINT	SSI 17 Bits	Inactive	
Comparator 2	Enumeration of USINT	SSI 18 Bits	Inactive	
🖤 🖗 Scaling	BOOL	SSI 20 Bits	FALSE	
Reversal of rotational direction	BOOL	SSI 21 Bits	FALSE	
🛄 🖗 Latch	Enumeration of USINT	SSI 22 Bits SSI 23 Bits	Inactive	
		SSI 24 Bits SSI 25 Bits SSI 26 Bits SSI 27 Bits SSI 28 Bits SSI 29 Bits SSI 30 Bits SSI 31 Bits		

FCT640:

• Configurazione corretta:

CMZ.HBUS Parameters 🗮 CMZ.HBUS I/O M	tapping 🗮 CMZ.HBUS IEC (bjects Status 🕕 Info	rmation				CMZ.HBUS Parameters	CMZ.HBUS I/O Mapping	🖴 CMZ.H	BUS IEC Objects Status 🌒 Info	rmation			
							Find	Filter	Show all		- 🕂 Add I	B for IO C	hannel	→ Go to Ins
Parameter	Туре	Current Value	Prepared Value	Value	Default Value U	Unit	Variable		Mapping	Channel	Address	Туре		Current Valu
😑 🚞 General							Application.PL	C_PRG.Counter		Encoder value	96ID4	UDINT	2830	
Diagnostic alarm	BOOL	TRUE	TRUE	TRUE	FALSE		- 7			Ready for operation	%DX20.0	BOOL	TRUE	
Grav-/Dual Converter	Enumeration of USINT	Grav		Grav	Grav		- 10			Error absolute encoder	%D(20.1	BOOL	FALSE	
Encoder type	Enumeration of USINT	SSI 13 Bits		SSI 13 Bits	SSI 15 Bits		- *			Error auxiliary power supply	%D(20.2	BOOL	FALSE	
Total steps of absolut encoder	UDINT(162147483648)	8192	Coerenti	8192	32768					Latch-mode active	%DX20.3	BOOL	FALSE	
Number of trailing bits	USINT(015)	0		0	0		- *			Status DI	%D(20.4	BOOL	FALSE	
Parity	Enumeration of USINT	None		None	None		*>			Status DN	%DX20.5	BOOL	FALSE	
Penetition	Enumeration of LISINT	Inactive		Inactive	Inactive		- *			Status UP	%D(20.6	BOOL	FALSE	
A Raudicate	Enumeration of USINT	125 /44*		125 644	125 644		- *			Comparison value 1 reached	%D(20.7	BOOL	FALSE	
A Manaflan time	Enumeration of USINT	22.00		22.00	22.00					Comparison value 2 reached	%D(21.0	BOOL	FALSE	
Generates 1	Enumeration of USB/T	Sz ps		52 ps	Jac po					Load function error	%D(21.1	BOOL	FALSE	
Comparator 1	Enumeration of USINT	Forward direction		Forward direction	Inacuve		- **			Load function running	%DX21.2	BOOL	FALSE	
Comparator 2	Enumeration of USINT	Porward direction		Porward direction	inacove		- **			Comparison value 1 or 2	%QD4	UDINT	0	
 Ø scaing 	BOOL	FALSE		FALSE	FALSE		- **			Adknowledgement of error	%OX20.0	BOOL	FALSE	
 Reversal of rotational direction 	BOOL	FALSE		FALSE	FALSE		- 50			Acknowledgement of latch-mode	%OX20.1	BOOL	FALSE	
···· 🖗 Latch	Enumeration of USINT	With rising edge DI		With rising edge DI	Inactive		- 10			Load comparison value 1	%OX20.2	BOOL	FALSE	
							5.						CAL OF	



• Configurazione errata, il modulo non funziona, il led rosso è acceso e a livello IEC non viene riportata nessuna info:

							Find	Filter Show all		👻 🌵 Add F	B for IO Ch	annel	* Go to Insta
Parameter	Туре	Current Value	Prepared Value	Value	Default Value	Unit	it Variable	Mapping	Channel	Address	Туре		Current Value
- 🧀 General							- * Application.PLC_PRG.Counter	*	Encoder value	%ID4	UDINT	0	
Diagnostic alarm	BOOL	TRUE	TRUE	TRUE	FALSE		- *		Ready for operation	%IX20.0	BOOL	FALSE	
 Ø Gray-/Dual Converter 	Enumeration of USINT	Gray		Gray	Gray	_			Error absolute encoder	%JX20.1	BOOL	FALSE	
Encoder type	Enumeration of USINT	SSI 13 Bits		SSI 12.04	SSI 15 Bits	-	- *		Error auxiliary power supply	%IX20.2	BOOL	FALSE	
 Total steps of absolut encoder 	UDINT(162147483648)	32768		32768	32768		- *		Latch-mode active	%IX20.3	BOOL	FALSE	
Number of trailing bits	USINT(015)	0		0	0		- *		Status DI	%IX20.4	BOOL	FALSE	
🛊 Parity	Enumeration of USINT	None		None	None		- *		Status DN	%IX20.5	BOOL	FALSE	
Repetition	Enumeration of USINT	Inactive		Inactive	Inactive		- *		Status UP	%IX20.6	BOOL	FALSE	
 Ø Baud rate 	Enumeration of USINT	125 kHz		125 kHz	125 kHz		- *		Comparison value 1 reached	%IX20.7	BOOL	FALSE	
Monoflop time	Enumeration of USINT	32 µs		32 µs	32 µs		- **		Comparison value 2 reached	%IX21.0	BOOL	FALSE	
- Comparator 1	Enumeration of USINT	Forward direction		Forward direction	Inactive		- *		Load function error	%IX21.1	BOOL	FALSE	
Comparator 2	Enumeration of USINT	Forward direction		Forward direction	Inactive		- *		Load function running	%JX21.2	BOOL	FALSE	
- Ø Scaling	BOOL	FALSE		FALSE	FALSE		- 10		Comparison value 1 or 2	%QD4	UDINT	0	
Reversal of rotational direction	BOOL	FALSE		FALSE	FALSE		- **		Acknowledgement of error	%QX20.0	BOOL	FALSE	
- 🕈 Latch	Enumeration of USINT	With rising edge DI		With rising edge DI	Inactive		-**		Acknowledgement of latch-mode	%QX20.1	BOOL	FALSE	
							- **		Load comparison value 1	%QX20.2	BOOL	FALSE	
							L. 10		Load comparison value 2	%OX20.3	BOOL	FALSE	

Coupler EtherCAT:

Per eseguire una corretta configurazione il valore di "Encoder Type" deve essere coerente con il "Total steps of absolute encoder"; in pratica il valore del parametro "total step absolute encoder" deve essere inferiore o uguale al massimo numero codificabile dall'Encoder Type. Esempio: 13bit -> max codifica 8192 e non 32768.

Configurazione corretta:



• Configurazione errata:



Coupler CANopen:

Vedere Section 1.6, "Configurazione via CANopen"

1.3. Reset della Quota Encoder

Tramite un ingresso si attiva la funzione di Reset Quota Encoder, dopo questa azione il modulo va in errore (il led Blu diventa Rosso Fisso) la quota encoder si resetta e rimane congelata finché non si resetta l'errore tramite il bit Acknowledgement of Error (vedere *Section 1.5, "Variabili per il Reset dei fault"*).

FCT640:



Coupler EtherCAT:



1.4. Cattura Quota

Dopo un fronte sull'ingresso di cattura quota:

FCT640:

L'avvenuta cattura si notifica tramite il bit "Latch-mode Active", inoltre il bit 31 del Encoder Value si setta a TRUE ("sporcando" la quota dell'Encoder).

La quota Encoder rimane congelata finché non si setta il bit "Acknowledgement of latchmode" (vedere *Section 1.5, "Variabili per il Reset dei fault"*).

Variable	Mapping	Channel	Address	Туре	Current Value
Application.PLC_PRG.Counter	~⊘	Encoder value	%ID2	UDINT	2147483648
🍫		Ready for operation	%IX12.0	BOOL	TRUE
*		Error absolute encoder	%IX12.1	BOOL	FALSE
		Error auxiliary power supply	%IX12.2	BOOL	FALSE
		Latch-mode active	%IX12.3	BOOL	TRUE
🍫		Status DI	%IX12.4	BOOL	FALSE
		Status DN	%IX12.5	BOOL	TRUE
		Status UP	%IX12.6	BOOL	FALSE
*		Comparison value 1 reached	%IX12.7	BOOL	FALSE
		Comparison value 2 reached	%IX13.0	BOOL	FALSE
		Load function error	%IX13.1	BOOL	FALSE
		Load function running	%IX13.2	BOOL	FALSE
🍫		Comparison value 1 or 2	%QD2	UDINT	0
[*] ø		Acknowledgement of error	%QX12.0	BOOL	FALSE
🍫		Acknowledgement of latch-mode	%QX12.1	BOOL	FALSE
* ø		Load comparison value 1	%QX12.2	BOOL	FALSE
L		Load comparison value 2	%QX12.3	BOOL	FALSE

Coupler EtherCAT:

La quota Encoder rimane congelata finché non si setta il bit "Acknowledgement of latchmode" (vedere *Section 1.5, "Variabili per il Reset dei fault"*).

Non è presente il bit "Latch-mode Active", ma solo il bit 31 della Encoder Value.



1.5. Variabili per il Reset dei fault

FCT640 e Coupler EtherCAT

La struttura delle variabili è già precompilata. È importante notare che le variabili di reset dei fault nelle strutture dati precompilate hanno nomi diversi rispetto ai nomi riportati nei manuali dei moduli.

Questi ultimi si chiamano "Reset fault" e "Reset latch function", mentre nella struttura precompilata nell'FCT640 e nel Coupler EtherCAT si chiamano rispettivamente "Acknowledgment of error" e "Acknowledgment of latch-mode".

Status DN	%1X 12.5	BUUL	TRUE		
Status UP	%IX12.6	BOOL	FALSE		
Comparison value 1 reached	%IX12.7	BOOL	FALSE		
Comparison value 2 reached	%IX13.0	BOOL	FALSE	$\overline{}$	
Load function error	%IX13.1	BOOL	FALSE	Reset fault	This bit is used to reset the aforementioned faults/errors.
Load function running	%IX13.2	BOOL	FALSE		
Comparison value 1 or 2	%QD2	LIDING	U	Reset latch function	This bit is used to reset the latch function
Acknowledgement of error	%QX12.0	BOOL	FALSE	Reservation	This of is used to reset the laten function.
Acknowledgement of latch-mode	76QX12.1	BOOL	FALSE		
Load comparison value 1	%QX12.2	BOOL	FALSE	Load reference value 2	This bit is used to start transmitting the preset count (from bytes 0 to 3)
Load comparison value 2	%QX12.3	BOOL	FALSE		to comparator 2.
				Load reference value 1	This bit is used to start transmitting the preset count (from bytes 0 to 3) to comparator 1.

Coupler CANopen

La struttura delle variabili è definita dall'utente, quindi anche il loro nome. Viene riportato un esempio in *Section 1.6, "Configurazione via CANopen"*.

1.6. Configurazione via CANopen

• Per la lettura dell'encoder ed il monitor dello stato della periferica da CODESYS, serve fare il mapping sul TPD come in figura:

Name	Object	Bit length
16#1800: Transmit PDO Communication Parameter 1	16#181 (\$NODEID+16#180)	64
Digital Incut F , 1	16#6000;15#01	8
Digital inpul Pijta 2	*A-R-R-GB的公,199-199	8
SSI_EncValue	16#2101:16#01	32
SSI_State1	16#2101:16#02	8
SSI_State2	16#2101:16#03	8

Mappare le variabili IEC, come in figura:

SSI_State1 %iB20 BYTE MupState Bit0 %iX20.0 BOOL MupState Bit1 %iX20.0 BOOL MupState Bit1 %iX20.0 BOOL MupState Bit1 %iX20.1 BOOL MupState Bit1 %iX20.2 BOOL MupState Bit2 %iX20.3 BOOL MupState Bit3 %iX20.3 BOOL MupState Bit3 %iX20.4 BOOL MupState Bit4 %iX20.5 BOOL MupState Bit5 %iX20.6 BOOL MupState Bit6 %iX20.7 BOOL MupState Bit7 %iX20.7 BOOL MupState SSI_State2 %iB21 BYTE MupState Bit0 %iX21.0 BOOL MupState Bit1 %iX21.1 BOOL MupState Bit3 %iX21.3 BOOL MupState Bit3 %iX21.3 BOOL	🕮 🦄 EncSSI	***	SSI_EncValue	%ID4	DWORD
** UpState Bit0 %JX20.0 BOOL ** DnState Bit1 %JX20.1 BOOL ** DnState Bit1 %JX20.2 BOOL ** DiState Bit2 %JX20.2 BOOL ** DiState Bit2 %JX20.2 BOOL ** Fault24V Sit3 %JX20.3 BOOL ** EncoderFault Bit3 %JX20.4 BOOL ** EncoderFault Bit4 %JX20.5 BOOL ** EncoderFault Bit5 %JX20.6 BOOL ** EncoderFault Bit6 %JX20.7 BOOL ** ReadyXOp Bit6 %JX20.7 BOOL ** Neady Bit7 %JX20.7 BOOL ** LoadRun Bit7 %JX20.7 BOOL ** LoadError Bit1 %JX21.0 BOOL ** LoadError Bit3 %JX21.3 BOOL ** </td <td>🖹 🍫</td> <td></td> <td>SSI_State1</td> <td>%IB20</td> <td>BYTE</td>	🖹 🍫		SSI_State1	%IB20	BYTE
** DnState Bit1 %JX20.1 BOOL ** DiState Bit2 %JX20.2 BOOL ** Fault24V Bit3 %JX20.3 BOOL ** Fault24V Bit3 %JX20.4 BOOL ** EncoderFault Bit4 %JX20.4 BOOL ** EncoderFault Bit5 %JX20.4 BOOL ** EncoderFault Bit6 %JX20.5 BOOL ** ReadyXOp Bit6 %JX20.6 BOOL ** ReadyXOp Bit6 %JX20.7 BOOL ** LoadRun Bit7 %JX20.7 BOOL ** LoadRun Bit0 %JX21.0 BOOL ** LoadError Bit1 %JX21.0 BOOL ** LoadError Bit3 %JX21.4 BOOL ** Comp1State Bit3 %JX21.4 BOOL ** Comp1State Bit4 %JX21.5 BOOL <td< td=""><td>🗝 🦃 UpState</td><td>**</td><td>BitO</td><td>%IX20.0</td><td>BOOL</td></td<>	🗝 🦃 UpState	**	BitO	%IX20.0	BOOL
Image: Second	🗝 🤎 DnState	**	Bit1	%IX20.1	BOOL
** Fault24V Bit3 %JX20.3 BOOL ** EncoderFault Bit4 %JX20.4 BOOL ** EncoderFault Bit5 %JX20.5 BOOL ** EncoderFault Bit5 %JX20.5 BOOL ** EncoderFault Bit5 %JX20.5 BOOL ** ReadyXOp Bit6 %JX20.6 BOOL ** ReadyXOp Bit6 %JX20.7 BOOL ** ReadyXOp Bit7 %JX20.7 BOOL ** LoadRun Bit7 %JX20.7 BOOL ** LoadRun Bit0 %JX21.0 BOOL ** LoadError Bit1 %JX21.1 BOOL ** Comp2State Bit2 %JX21.2 BOOL ** Comp1State Bit3 %JX21.3 BOOL ** Comp1State Bit4 %JX21.4 BOOL ** Comp1State Bit5 %JX21.5 BOOL ** A Bit5 %JX21.6 BOOL ** A Bit5 %JX21.5 BOOL ** B Bit6 %JX21.6 BOOL ** B Bit6 %JX21.7 <td>🗝 🤎 DiState</td> <td>**</td> <td>Bit2</td> <td>%IX20.2</td> <td>BOOL</td>	🗝 🤎 DiState	**	Bit2	%IX20.2	BOOL
Image: Second	🌱 🦃 Fault24V	**	Bit3	%IX20.3	BOOL
Image: Constraint of the second se	🏘 EncoderFault	**	Bit4	%IX20.4	BOOL
A ReadyXOp Bit6 %JX20.6 BOOL Bit7 %JX20.7 BOOL Bit7 %JX20.7 BOOL SSI_State2 %JB21 BYTE SSI_State2 %JB21 BYTE Image: A LoadRun Min Min Bit0 %JX21.0 BOOL Image: A LoadRun Min Min Bit1 %JX21.0 BOOL Image: A LoadError Min Min Bit1 %JX21.1 BOOL Image: A Comp2State Min Min Bit2 %JX21.2 BOOL Image: A Comp1State Min	*		Bit5	%IX20.5	BOOL
Hom Bit7 %JX20.7 BOOL SSI_State2 %JB21 BYTE SSI_State2 %JB21 BYTE SSI_State2 %JB21 BOOL SSI_State2 %JB21 BOOL SSI_State2 %JB21 BOOL SSI_State2 %JB21 BOOL SSI_State2 %JZ21.0 BOOL SSI_State3 %JZ21.1 BOOL SSI_State3 %JZ21.2 BOOL SSI_State3 %JZ21.2 BOOL SSI_State3 %JZ21.3 BOOL SSI SSI %JZ21.4 BOOL SSI SSI SSI SSI SSI SSI SSI	🏘 ReadyXOp	**	Bit6	%IX20.6	BOOL
SSI_State2 %IB21 BYTE ** LoadRun Bit0 %ID21.0 BOOL ** LoadError Bit1 %ID21.0 BOOL ** LoadError Bit1 %ID21.1 BOOL ** Comp2State Bit2 %ID21.2 BOOL ** Comp1State Bit3 %ID21.3 BOOL ** Comp1State Bit4 %ID21.4 BOOL ** Comp1State Bit5 %ID21.5 BOOL ** Comp1State Bit5 %ID21.6 BOOL ** Comp1State Bit6 %ID21.5 BOOL	*		Bit7	%IX20.7	BOOL
** LoadRun Bit0 %IX21.0 BOOL *** LoadError Bit1 %IX21.1 BOOL *** Comp2State Bit2 %IX21.2 BOOL *** Comp1State Bit3 %IX21.3 BOOL *** Comp1State Bit4 %IX21.4 BOOL *** Bit5 %IX21.5 BOOL *** Bit5 %IX21.6 BOOL *** Bit6 %IX21.6 BOOL	🖨 🍫		SSI_State2	%IB21	BYTE
** LoadError Bit1 %JX21.1 BOOL *** Comp2State Bit2 %JX21.2 BOOL *** Comp1State Bit3 %JX21.3 BOOL *** Comp1State Bit4 %JX21.4 BOOL *** Bit4 %JX21.5 BOOL *** Bit5 %JX21.6 BOOL *** Bit6 %JX21.6 BOOL *** Bit7 %JX21.7 BOOL	🗝 🦃 LoadRun	**	BitO	%IX21.0	BOOL
** Comp2State Bit2 %JX21.2 BOOL -** Comp1State Bit3 %JX21.3 BOOL -** Comp1State Bit3 %JX21.4 BOOL -** Bit4 %JX21.5 BOOL -** Bit5 %JX21.5 BOOL -** Bit6 %JX21.6 BOOL -** Bit6 %JX21.7 BOOL	- 🏘 LoadError	**	Bit1	%IX21.1	BOOL
Image: Second	🗝 🤎 Comp2State	**	Bit2	%IX21.2	BOOL
Here Bit4 %JX21.4 BOOL Here Bit5 %JX21.5 BOOL Here Bit6 %JX21.6 BOOL Here Bit6 %JX21.7 BOOL	🤎 Comp1State	**	Bit3	%IX21.3	BOOL
Home Bit5 %1X21.5 BOOL Home Bit6 %1X21.6 BOOL Home Bit7 %1X21.7 BOOL	🍗		Bit4	%IX21.4	BOOL
Bit6 %JX21.6 BOOL % Bit7 %JX21.7 BOOL	🍬		Bit5	%IX21.5	BOOL
Bit7 %IX21.7 BOOL	🍬		Bit6	%IX21.6	BOOL
			Bit7	%IX21.7	BOOL

Input space length: 6 bytes

	7	6	5	4	3	2	1	0	
Bytes 0–3		B:	its 0-30 =	Encoder valu	ue; bit 31	= Latch acti	ve		16#2101.1
Byte 4	Reserved	Ready for operation	Reserved	Encoder value fault	24-V encoder supply fault	DI state	DN state	UP state	16#2101.2
Byte 5	Reserved	Reserved	Reserved	Reserved	Comparato r 1 state	Comparator 2 state	Loading function error	Loading function running	16#2101.3
Encoder	value		Bytes 0 to whether t contain th value is a	o 3 contain th he latch func ne current end stored value	ne current en tion is activ coder value / that the la	ncoder value re. More spec and bit 31 in tch function	and a bit indi ifically, bits dicates that t is active.	cating 0 to 30 he encoder	
Ready for	r operation		Byte 4, bi operation connected	it 6 is used to , i.e., that con d encoder are	signal that mmunication OK.	the TB20 SS ns between th	I module is r he module an	eady for id the	
Absolute	encoder fa	ult	Byte 4, bit 4 is used to signal faults such as wire breaks and parity errors detected when communicating with the absolute encoder. The corresponding fault needs to be reset before the module can be used.						
24-Venc	oder supply	fault	Byte 4, bit 3 is used to signal faults in the 24-V encoder supply.						
DI state			The corre used. Byte 4, bi	esponding fau it 2 is used to	ult needs to signal the	be reset befor state of the la	re the module	can be s digital	
DN state			Byte 4. b	it 1 is used to	signal a ne	gative directi	on of moven	ient.	
UP state			Byte 4, b	it 0 is used to	signal a po	sitive directio	on of movem	ent.	
Compara	tor 1 state		Byte 5, bi 8.1.6).	t 3 is used to	signal the	state of comp	arator 1 (plea	ase refer to	
Compara	tor 2 state		Byte 5, bi 8.1.6).	t 2 is used to	signal the s	tate of comp	arator 2 (plea	se refer to	
Loading f	unction err	or	Byte 5, bit to execute reference and 1) are	1 is used to the loading value 2" and to be set to 0	indicate tha function. To "load refere).	t an error occ o eliminate th ence value 1"	curred when a e error bits " (output byte	attempting load 4, bits 0	
Loading f	unction run	ning	Byte 5, bit	0 is used to	signal that t	the loading fi	unction is act	ive.	

• Per gestire la periferica, il Reset Fault, l'attivazione del trigger ed il Reset Latch della quota, serve mappare l'RPD come in figura:

Move Down	
Object	Bit length
16#201 (\$NODEID+16#200)	64
-++o200:16#01	8
10#0200:16#02	8
1040107 10707	8
16#2201:16#01	32
16#2201:16#02	8
	Object 16#201 (\$NODEID+16#200) ++0200136#01 10+0200136#01 10+0200136#02 10+020136#02 10+020136#01 16#2201:16#01 16#2201:16#02

Assegnare l'indirizzo alle variabili IEC come in figura:

🗄 🧖 SSI_SetQuota	**	SSI_PresetCount	%QD3	DWORD	
🚔 ^K ø		SSI_CtrlByte	%QB16	BYTE	
ToadRefValue1	***	Bit0	%QX16.0	BOOL	
ToadRefValue2	**	Bit1	%QX16.1	BOOL	
🍫		Bit2	%QX16.2	BOOL	
*>		Bit3	%QX16.3	BOOL	
🍫		Bit4	%QX16.4	BOOL	
🍫		Bit5	%QX16.5	BOOL	
🧖 ResetLatch	**	Bit6	%QX16.6	BOOL	
🔤 🍫 ResetFault	**	Bit7	%QX16.7	BOOL	

Output space length: 6 bytes

	7	6	5	4	3	2	1	0	
Bytes 0-3		Preset count for reference value 1 or 2							
Byte 4	Reset fault	Reset latch function	Reserved	Reserved	Reserved	Reserved	Load reference value 2	Load reference value 1	16#22
Byte 5	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	

Preset count for reference value	Used to specify the count that will be used as a reference value by the comparator.
Reset fault	This bit is used to reset the aforementioned faults/errors.
Reset latch function	This bit is used to reset the latch function.
Load reference value 2	This bit is used to start transmitting the preset count (from bytes 0 to 3) to comparator 2.
Load reference value 1	This bit is used to start transmitting the preset count (from bytes 0 to 3) to comparator 1.

• Per cambiare la configurazione del Modulo di acquisizione dell'Encoder_SSI si può procedere in due modi:



Info Extended General	
Diagnostic alarm	
Gray-/Dual Converter	Gray 🗸
Encoder type	SSI 15 Bits 🗸
Total steps of absolut encoder	32768
Number of trailing bits	0
Parity	None 🗸
Repetition	Inactive ~
Baud rate	125 kHz 🗸
Monoflop time	32 µs ∨
Comparator 1	Inactive ~
Comparator 2	Inactive ~
Scaling	
Reversal of rotational direction	
Latch	Inactive ~

- 1. Tramite ToolBOX:
 - a. Creare un progetto con tutti i moduli I/O presenti.
 - b. Andare nella tab di configurazione del modulo SSI e cambiarla:
 - i. Salvando il file EDS --> importarlo in CODESYS
 - ii. Salvando nel Coupler CANopen la configurazione appena fatta



Scegliere una delle due vie: salvataggio dei parametri nel nodo oppure importazione tramite file EDS.

2. Tramite SDO:

alla fine della fase di inizializzazione del modulo è possibile, in CODESYS, scaricare nel nodo tramite SDO una lista di parametri. Grazie a questa procedura si può modificare l'impostazione della scheda SSI.

15	16#3001:16#01	Module Slot 1 Parameter 1	1	8
16	16#3001:16#02	Module Slot 1 Parameter 2	13	8
17	16#3001:16#03	Module Slot 1 Parameter 3	8192	32
18	16#3001:16#04	Module Slot 1 Parameter 4	0	8
19	16#3001:16#05	Module Slot 1 Parameter 5	1	8
20	16#3001:16#06	Module Slot 1 Parameter 6	17	8
21	16#3001:16#07	Module Slot 1 Parameter 7	129	8

Per come comporre i vari parametri di configurazione, riferirsi alla seguente tabella:

Byte	7	6	5	4	3	2	1	0
0				Opera	ting mode			
1	Encoder value coding			Enco	der value bit	t width		
2-5			То	tal number	of encoder s	steps		
6	Mult transm	tiple Mission	Par	ity	N	umber of appe	nded bits	
7		Baud	rate		Monostak	ole multivibra	tor time p	eriod
8		Comparat	or 2 mode			Comparator	1 mode	
9	Diagnosi s alarm	Reserved	Reserved	Reserved	Normaliza tion	Direction reversal	Lat	ch
Opera	ating mode		1 = Op	erating mod	<u>le 1</u>			
Enco	der value c	oding	0 = Gra	<u>ay code</u> ; 1 =	= Natural bina	ary code		
Епсо	der value b	it width	0 = No	encoder				
			8 = 8 b	its $/9 = 9$ b	oits $//15 = 1$	<u>15 bits</u> / / 31	= 31 bits (v	with no p
Total	number of	encoder ste	eps (16 – 2	^31); (16,	, <u>32768</u> ,,	2147483648)		
Multi	ple transm	ission	$\frac{0 = N0}{1 - 2 = 1}$	multiple tr	ansmission	4.1.2.41.	1	
D	1.4		1 - 3 = 1	viuutipie tra	insmission wi	th 1-3 the cyc	cles	
Parity	v Dit	1 11	$\underline{0 = N0}$	ne; I = Odd	1; 2 = Even			
Numb	er of appe	naea Dits	0 bits-	15 Dits				
Baud	rate/Clock	frequency	0 = 125	5 kHz; 1 = 2	250 kHz; 2 =	500 kHz; $3 = 1$	l MHz;	
			4 = 1.5	MHz; $5 = 1$	2 MHZ	40 0 0		
Mono	stable mul	tivibrator ti	me period	$0 = 16 \ \mu s;$	$1 = 32 \ \mu s; 2$	$= 48 \ \mu s; \ 3 = 6$	4 µs	
Comp	arator 1/2	mode	0 = Dis direction	<u>abled</u> ; 1 = 1 ons	Forward dire	ction; $2 = \text{Rev}$	erse directio	on; $3 = E$
Diagi	nosis alarn	1	0 = Dis	abled; 1 =	Enabled			
Norm	alization		0 = Dis	abled; 1 =	Enabled			
Direc	tion revers	al	0 = Dis	abled; 1 =	Enabled			
Latch			$\frac{0 = \text{Dis}}{2 = \text{Fal}}$	abled; 1 = 1 ling edge a	Rising edge a t DI; 3 = Botl	t DI; h edges at DI		

1.7. Risoluzione dei problemi

- 1. Non viene inviato il TPDO della quota:
 - a. Verificare che il PDO mapping sia impostato a 255
 - b. Ristabilire la configurazione di default del Nodo TB20 Coupler tramite ToolBox



Info Settings	
Name: CANopen coupler	Save diagnostic
Serial: 106296	FW-Update
FW-Version: 1.10.002	Restart
G-Version. 1.00.002	Factory setting
App state: Operational	Operational
Node-ID: 1 CAN baud rate (Bit/s): 1000000	Preoperational
Initialisation finished: Yes	SDO

- 2. Non funziona il latch della quota e/o non si attiva il comparatore di quota:
 - a. Verificare/modificare le impostazioni di default del Modulo

Info Extended General	
Diagnostic alarm	
Gray-/Dual Converter	Gray 🗸
Encoder type	SSI 15 Bits 🗸
Total steps of absolut encoder	32768
Number of trailing bits	0
Parity	None 🗸
Repetition	Inactive ~
Baud rate	125 kHz 🗸
Monoflop time	32 µs \vee
Comparator 1	Inactive ~
Comparator 2	Inactive \lor
Scaling	
Reversal of rotational direction	
Latch	Inactive ~

3. L'encoder SSI dell'Eltra prevede un ingresso per resettare la quota. Quando si esegue il reset tramite questo ingresso dell'encoder, il modulo di acquisizione SSI va in errore (probabilmente a fronte di un "salto" di quota). Lo stato di errore del modulo si resetta tramite il bit7 della cella CAN 16#2201.2.

2. English

2.1. Introduction

The purpose of this application note is to help the user to configure a TB20 SSI module with a FCT640 controller, showing an application example. It is recommended to save this product with the product. For more complete information about the module or the controller, please refer to the documents that are available in the http://www.cmz.it website or contact CMZ SISTEMI ELETTRONICI S.r.l..

The example that is reported in this document consist of the connection of an Encoder SSI of Eltra with 13bit Gray code (8192 pulses in primary wave) to the 640-320-7AA01 Module and try the various functionalities, that are provided by the module, on:

- 1. HBUS of FCT640
- 2. Coupler EtherCAT
- 3. Coupler CANopen

2.2. Setting of "Encoder Type" and "Total Steps of Absolute Encoder"

The setting of the encoder type seems not to work because the only admissible configuration is SSI 15 bit (Default configuration).

If the SSI 13 bit is set, the red led of the module blinks Red "parameter assignment error".

Cause: the not coherence between the Encoder "SSI 13 bits" setting and the "Total steps of Absolute Encoder" parameter

FCT640:

• Correct configuration:

MZ.HBUS Parameters CMZ.HBUS I/O M	lapping 🗮 CMZ.HBUS IEC (Objects Status 💔 Info	rmation				LMZ.HBUS Parameters — CMZ.HBUS I/O Mapping	CMZ.H	BUS IEC Objects Status 🕕 Info	rmation			
						ł	Find Filte	r Show all		- 🕂 Add	FB for IO C	hannel	* Go to Ir
Darameter	Time	Current Value	Prenared Value	Value	Default Value 11	Init	Variable	Mapping	Channel	Address	Туре		Current Va
- Caneral	990	current folde	rieparea valae	Vulue	Derudit Value 0		Application.PLC_PRG.Counter	*	Encoder value	%ID4	UDINT	2830	
Biagnostic alarm	800	TRUE	TRUE	TRUE	FAI SE		**		Ready for operation	%D(20.0	BOOL	TRUE)
di Grav-Dual Converter	Enumeration of USINT	Grav		Grav	Grav		**		Error absolute encoder	%IX20.1	BOOL	FALSE	
Ordy Joba Contents	Enumeration of USINT	CET 12 Bits		CCT 12 Bits	CCT 15 Pite		- *		Error auxiliary power supply	%D(20.2	BOOL	FALSE	
Cricoler type A Total store of sharp it associate	LIDING 2147403640	33113065	Coerenti	331 13 015	331 13 015		*>		Latch-mode active	%D(20.3	BOOL	FALSE	
 Protal steps of absolut encoder 	UDINT(102147403040)	8192		0192	32/00		**		Status DI	%IX20.4	BOOL	FALSE	
w number of traing bits	USINI (015)								Status DN	%D(20.5	BOOL	FALSE	
Panty	Enumeration of USINI	None		None	None		- **		Status UP	%DX20.6	BOOL	FALSE	
Repetition	Enumeration of USINT	Inactive		Inactive	Inactive		- *		Comparison value 1 reached	%IX20.7	BOOL	FALSE	
Baud rate	Enumeration of USINT	125 kHz		125 kHz	125 kHz		- *		Comparison value 2 reached	%D(21.0	BOOL	FALSE	
Monoflop time	Enumeration of USINT	32 µs		32 µs	32 µs		10		Load function error	%D(21.1	BOOL	EAL SE	
🌵 Comparator 1	Enumeration of USINT	Forward direction		Forward direction	Inactive				Load 6 metion or mains	9/1/21/2	8000	EAL CE	
 Ø Comparator 2 	Enumeration of USINT	Forward direction		Forward direction	Inactive				Concentration of the Concentration	761/21.2	LONG	- ALGE	
- 🖗 Scaling	BOOL	FALSE		FALSE	FALSE				Comparison value 1 or 2	76QU4	COINT	U CALLOR	
Reversal of rotational direction	BOOL	FALSE		FALSE	FALSE				Addrowledgement of error	%QX20.0	BOOL	FALSE	
Latch	Enumeration of USINT	With rising edge DI		With rising edge DI	Inactive				Acknowledgement of latch-mode	%QX20.1	BOOL	FALSE	
									Load comparison value 1	%QX20.2	BOOL	FALSE	1

• Wrong configuration, the module doesn't work, the red led is on and at IEC level no info is reported:

						1	ind	Filter	Show all		👻 🖶 Add F	B for IO CH	annel	* Go to Ins
rameter	Туре	Current Value	Prepared Value	Value	Default Value U	Jnit	Variable		Mapping	Channel	Address	Туре		Current Val
ia General							- * Application.PLC_P	RG.Counter	۰.	Encoder value	%ID4	UDINT	0	
Diagnostic alarm	BOOL	TRUE	TRUE	TRUE	FALSE		- *			Ready for operation	%IX20.0	BOOL	FALSE	
🖗 Gray-/Dual Converter	Enumeration of USINT	Gray	_	Gray	Grav	_	10 m			Error absolute encoder	%IX20.1	BOOL	FALSE	
Encoder type	Enumeration of USINT	SSI 13 Bits		SSI 12.00	SSI 15 Bits		- *			Error auxiliary power supply	%IX20.2	BOOL	FALSE	
 Protal steps of absolut encoder 	UDINT(162147483648)	32768		32768	32768		🍫			Latch-mode active	%IX20.3	BOOL	FALSE	
Number of trailing bits	USINT(015)	0		0	0		🐪			Status DI	%IX20.4	BOOL	FALSE	
- 🔶 Parity	Enumeration of USINT	None		None	None		🍫			Status DN	%EX20.5	BOOL	FALSE	
- 🗼 Repetition	Enumeration of USINT	Inactive		Inactive	Inactive		🍫			Status UP	%IX20.6	BOOL	FALSE	
- 🖗 Baud rate	Enumeration of USINT	125 kHz		125 kHz	125 kHz		🍫			Comparison value 1 reached	%IX20.7	BOOL	FALSE	
 Ø Monoflop time 	Enumeration of USINT	32 µs		32 µs	32 µs		🍫			Comparison value 2 reached	%IX21.0	BOOL	FALSE	
- 🕈 Comparator 1	Enumeration of USINT	Forward direction		Forward direction	Inactive		🍫			Load function error	%EX21.1	BOOL	FALSE	
 	Enumeration of USINT	Forward direction		Forward direction	Inactive		🍫			Load function running	%JX21.2	BOOL	FALSE	
- 🖗 Scaling	BOOL	FALSE		FALSE	FALSE		- **			Comparison value 1 or 2	%QD4	UDINT	0	
 Provide the second secon	BOOL	FALSE		FALSE	FALSE		- **			Acknowledgement of error	%QX20.0	BOOL	FALSE	
🖉 🌢 Latch	Enumeration of USINT	With rising edge DI		With rising edge DI	Inactive		- **			Acknowledgement of latch-mode	%QX20.1	BOOL	FALSE	
							- **			Load comparison value 1	%QX20.2	BOOL	FALSE	
							- * *			Load comparison value 7	SIOX20_3	BOOL	EALSE	

Coupler EtherCAT:

To follow a correct configuration the "Encoder Type" value must be coherent with the "Total steps of absolute encoder"; in other words, the value of the "total step absolute encoder" parameter must be lower or equal to the maximum number that can be encoded by the Encoder Type. Example: 13bit -> max encoding 8192 and not 32768.

• Correct configuration:



• Wrong configuration:



Coupler CANopen:

See Section 2.6, "Configuration via CANopen"

2.3. Encoder Position Reset

Through an input it can be activated the Encoder Position Reset function, after this action the module returns an error (the Blue led becomes Red ON fixed), the encoder position resets and remains "frozen" until the error is reset through the bit Acknowledgement of Error (see *Section 2.5, "Variables for the fault Reset"*).

FCT640:

Devices - I X	I SSI 1x Default ¥						SSI_1x_Default x		
TestTR27 ICI Sociale	CMZ HBUS Decementaria	1 CM7 H	PLIC IEC Objecto - Status - 🙃 Tefer	mation			CMZ.HBUS Parameters 🗮 CMZ.HBUS I/O Mapping 🗮 CMZ.HBUS IEC Object	Status (1) Information	
	CM2. HOUS Parameters - Ch2. Hous to Houping	- UMZ.H	bus ieu objects status 🕕 intol	mation			🖷 Add 📝 Edit 🔀 Delete 😁 Go to Variable		
B B R C Look	Find Filter	Show all		• · · · · Add	B for IO Ch	annel Go i	formation .	Terr	Mahar
= O Application [run]	Variable	Mapping	Channel	Address	Туре	Curren	Expression	CM7 HPLIC HPLIC Medide	value
Library Manager	- * Application.PLC_PRG.Counter	*	Encoder value	%ID4	UDINT	0	A Eashie	ROOM ROOM	TRUE
PLC_PRG (PRG)	- *		Ready for operation	%IX20.0	BOOL	FALSE	????	800	EALSE
Prg_ECAT (PRG)	- *		Error absolute encoder	%IX20.1	BOOL	TRUE	A ALL A	FODO	NO EPROP
E 🔯 Task Configuration	- *		Error auxiliary power supply	%IX20.2	BOOL	FALSE	Sa Cata	ERROR	Operational
B 😏 😒 EtherCAT Task	- *		Latch-mode active	%IX20.3	BOOL	FALSE	A MadulaDapition	HOLE STATE	operacional
(B) Pro ECAT	- *		Status DI	%JX20.4	BOOL	FALSE	Sa Sueste	Costri	- 2
🖻 😏 🌚 MainTask	- 10		Status DN	%IX20.5	BOOL	FALSE	e cvents	Evens	-
- B) PLC PRG	- 10		Status UP	%JX20.6	BOOL	FALSE			-
Contrace Trace	- 19		Comparison value 1 reached	%IX20.7	BOOL	FALSE	vencriags	ARRAT [04] OF Eventhags	
EtherCAT Master (EtherCAT Master)	- 19		Comparison value 2 reached	%IX21.0	BOOL	FALSE	Pro Change of The Distinct Change of The	Eventhags	CALCO.
EtherCAT (TB20 Coupler EtherCAT (TB20 Coupler EtherCAT (- 10		Load function error	%IX21.1	BOOL	FALSE	Busstatus_changed robisonctsoc	BOOL	FALSE
1x SSI 640 320 7AA01 (1 x SSI encoder inte	- 10		Load function running	%IX21.2	BOOL	FALSE	Weddarfurged	BOOL	FALSE
SoftMotion General Axis Pool	- 10		Comparison value 1 or 2	%OD4	UDINT	0	 ModulePlugged 	BOOL	FALSE
B SH HBUS Master (HBUS Master)	- 10		Acknowledgement of error	%OX20.0	BOOL	FALSE	ModuleRemoved	BOOL	PALSE
G III CNT 1x 24V Counter mode (CNT 1x 24V Counter			Acknowledgement of latch-mode	%OX20.1	BOOL	FALSE	 	EventHags	CALL OF
SST ty Default (SST ty Default)			Load comparison value 1	960320.2	8001	FALSE	Busstatus_Changed IoDistinctSoc	BOOL	FALSE
			Load comparison value 2	96032012	800	FALSE	DiagStatus_Changed	BOOL	FALSE
			code companion reade 2	100ghtorio	0000		ModulePlugged	BOOL	FALSE
							ModuleRemoved	BOOL	FALSE
							# Ø EventFlags[2]	EventFlags	
							# Ø EventFlags[3]	EventFlags	
							• • • EventFlags[4]	EventFlags	
							DiagnosticStatus	ARRAY [04] OF DiagnosticEventStatus	
							DiagnosticStatus[0]	DiagnosticEventStatus	
							Length	USINT	0
							🗷 🌻 Data	ARRAY [032] OF BYTE	
							DiagnosticStatus[1]	DiagnosticEventStatus	

Coupler EtherCAT:



2.4. Position Capture

After a signal edge on the position capture input:

FCT640:

The capture happening is reported by the bit "Latch-mode Active" bit, furthermode the bit 31 of the Encoder Value is set to TRUE ("dirtying" the Encoder position).

The Encoder position remains "frozen" until the bit "Acknowledgement of latch-mode bit" is set (see *Section 2.5, "Variables for the fault Reset"*).

Variable	Mapping	Channel	Address	Туре	Current Value	F
- 🏧 Application.PLC_PRG.Counter	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	Encoder value	%ID2	UDINT	2147483648	
*		Ready for operation	%IX12.0	BOOL	TRUE	
**		Error absolute encoder	%IX12.1	BOOL	FALSE	
¥ø		Error auxiliary power supply	%IX12.2	BOOL	FALSE	
*		Latch-mode active	%IX12.3	BOOL	TRUE	
		Status DI	%IX12.4	BOOL	FALSE	
*		Status DN	%IX12.5	BOOL	TRUE	
		Status UP	%IX12.6	BOOL	FALSE	
*		Comparison value 1 reached	%IX12.7	BOOL	FALSE	
¥ø		Comparison value 2 reached	%IX13.0	BOOL	FALSE	
*		Load function error	%IX13.1	BOOL	FALSE	
¥ø		Load function running	%IX13.2	BOOL	FALSE	
*		Comparison value 1 or 2	%QD2	UDINT	0	
🍫		Acknowledgement of error	%QX12.0	BOOL	FALSE	
* ø		Acknowledgement of latch-mode	%QX12.1	BOOL	FALSE	
K ø		Load comparison value 1	%QX12.2	BOOL	FALSE	
- L No.		Load comparison value 2	%QX12.3	BOOL	FALSE	

Coupler EtherCAT:

The Encoder position remains "frozen" until the bit "Acknowledgement of latch-mode bit" is set (see *Section 2.5, "Variables for the fault Reset"*).

It is not present the "Latch-mode Active" bit, but only the bit 31 of the Encoder Value.



2.5. Variables for the fault Reset

FCT640 and Coupler EtherCAT

The variables structure is pre-compiled. It is important to notice that the fault reset variables in the pre-compiled data structures have different names compared to the names reported in the modules manuals.

The latter are called "Reset fault" and "Reset latch function", while in the pre-compiled structure in the FCT640 and in the Coupler EtherCAT that are called respectively "Acknowledgment of error" and "Acknowledgment of latch-mode".



	%1X12.5	BOOL	IKUE		
Status UP	%IX12.6	BOOL	FALSE		
Comparison value 1 reached	%IX12.7	BOOL	FALSE		
Comparison value 2 reached	%IX13.0	BOOL	FALSE		
Load function error	%IX13.1	BOOL	FALSE	Reset fault	This bit is used to reset the aforementioned faults/errors.
Load function running	%IX13.2	BOOL	FALSE		
Comparison value 1 or 2	%QD2	LIDINT	U	Reset latch function	This hit is used to reset the latch function
Acknowledgement of error	%QX12.0	BOOL	FALSE	Reservation	This of is used to reset the laten function.
Acknowledgement of latch-mode 🛛 🗕	76QX12.1	BOOL	FALSE		
Load comparison value 1	%QX12.2	BOOL	FALSE	Load reference value 2	This bit is used to start transmitting the preset count (from bytes 0 to 3)
Load comparison value 2	%QX12.3	BOOL	FALSE		to comparator 2.

Coupler CANopen

The structure of the variables is defined by the user, so even their name. An example is reported in *Section 2.6, "Configuration via CANopen"*.

2.6. Configuration via CANopen

• For the encoder reading and the monitor of the peripheral status from CODESYS, the mapping on TPD must be done as shown in the following picture:

Object	Bit length
16#181 (\$NODEID+16#180)	64
16#5000;15#01	8
*A#6000	8
16#2101:16#01	32
16#2101:16#02	8
16#2101:16#03	8
	Object 16#181 (\$NODEID+16#180) 16#6000:16#01 16#2101:16#01 16#2101:16#02 16#2101:16#03

IEC variables mapping, as shown in the following picture:

🕸 🦘 EncSSI	**	SSI_EncValue	%ID4	DWORD
🖹 🏘		SSI_State 1	%IB20	BYTE
👋 UpState	**	BitO	%IX20.0	BOOL
👋 DnState	**	Bit1	%IX20.1	BOOL
👋 DiState	**	Bit2	%IX20.2	BOOL
🗝 🦃 Fault24V	**	Bit3	%IX20.3	BOOL
👻 🦃 EncoderFault	**	Bit4	%IX20.4	BOOL
🍫		Bit5	%IX20.5	BOOL
👋 ReadyXOp	**	Bit6	%IX20.6	BOOL
L		Bit7	%IX20.7	BOOL
⇒ ¥ø		SSI_State2	%IB21	BYTE
👋 LoadRun	**	Bit0	%IX21.0	BOOL
🗝 🦃 LoadError	**	Bit1	%IX21.1	BOOL
🗝 🦃 Comp2State	**	Bit2	%IX21.2	BOOL
🗝 🦃 Comp1State	**	Bit3	%IX21.3	BOOL
* >		Bit4	%IX21.4	BOOL
🍫		Bit5	%IX21.5	BOOL
🍫		Bit6	%IX21.6	BOOL
* ø		Bit7	%IX21.7	BOOL

input spu	ee lengui. e	- Jues							
	7	6	5	4	3	2	1	0	
Bytes 0-3		B:	its 0-30 =	Encoder valu	ue; bit 31	= Latch acti	ve		16#2101.1
Byte 4	Reserved	Ready for operation	Reserved	Encoder value fault	24-V encoder supply fault	DI state	DN state	UP state	16#2101.2
Byte 5	Reserved	Reserved	Reserved	Reserved	Comparato r 1 state	Comparator 2 state	Loading function error	Loading function running	16#2101.3
Encoder value			Bytes 0 to whether t contain th value is a	5 3 contain th he latch func he current end stored value	tion is activ coder value / that the la	ncoder value e. More spec and bit 31 ind tch function	and a bit indi ifically, bits licates that t is active.	cating 0 to 30 he encoder	
Ready for	r operation		Byte 4, bi operation connected	Byte 4, bit 6 is used to signal that the TB20 SSI module is ready for operation, i.e., that communications between the module and the connected encoder are OK.					
Absolute encoder fault			Byte 4, bit 4 is used to signal faults such as wire breaks and parity errors detected when communicating with the absolute encoder. The corresponding fault needs to be reset before the module can be used.						
24-Venc	oder supply	fault	Byte 4, bit 3 is used to signal faults in the 24-V encoder supply.						
DI state			The corresponding fault needs to be reset before the module can be used. Byte 4, bit 2 is used to signal the state of the latch function's digital						
DN state			дри. Byte 4 bit 1 is used to signal a negative direction of movement						
UP state	te Byte 4, bit 0 is used to signal a positive direction of movement								
Compara	mparator 1 state			parator 1 state Byte 5, bit 3 is used to signal the state of comparator 1 (please refer to 81.6)					
Compara	nparator 2 state			arator 2 state Byte 5, bit 2 is used to signal the state of comparator 2 (please refer to 8.1.6).					
Loading f	unction err	or	Byte 5, bit 1 is used to indicate that an error occurred when attempting to execute the loading function. To eliminate the error bits "load reference value 2" and "load reference value 1" (output byte 4, bits 0 and 1) are to be set to 0.						
Loading f	unction run	ning	Byte 5, bit	0 is used to	signal that t	the loading fu	unction is act	ive.	

Input space length: 6 bytes

• To manage the peripheral, the Fault Reset, the trigger activation and the Reset Latch of the position, it is necessary to map the RPD as shown in the following picture:

Receive PDOs (Master => Slave)							
🕂 Add PDO 🕂 Add Mapping 💉 Edit 🗙 Delete 🌴 Move Up 🔸 Move Down							
Name	Object	Bit length					
16#1400: Receive PDO Communication Parameter 1	16#201 (\$NODEID+16#200)	64					
Cipital Output Print 1	-++6200:10#01	8					
Dinital O. S. L. Dyte 2	10#dz00:16#02	8					
Digital Ordena Byte L	10#5103 \$C#02	8					
SSI_PresetCount	16#2201:16#01	32					
SSI_CtrlByte	16#2201:16#02	8					

Assign the address to the IEC variables as shown in the following picture:

🗄 🧖 SSI_SetQu	uota	**	SSI_PresetCount	%QD3	DWORD	
i			SSI_CtrlByte	%QB16	BYTE	
🍫 LoadR	RefValue1	**	Bit0	%QX16.0	BOOL	
🍫 LoadR	RefValue2	**	Bit1	%QX16.1	BOOL	
···· *ø			Bit2	%QX16.2	BOOL	
···· *ø			Bit3	%QX16.3	BOOL	
···· *ø			Bit4	%QX16.4	BOOL	
*@			Bit5	%QX16.5	BOOL	
🔮 🍫 Reset	Latch	**	Bit6	%QX16.6	BOOL	
🦾 🍫 Reset	Fault	**	Bit7	%QX16.7	BOOL	

Output space length: 6 bytes

	7	6	5	4	3	2	1	0	
Bytes 0-3	Preset count for reference value 1 or 2								16#2201.1
Byte 4	Reset fault	Reset latch function	Reserved	Reserved	Reserved	Reserved	Load reference value 2	Load reference value 1	16#2201.2
Byte 5	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	

Preset count for reference value Used to specify the count that will be used as a reference value by the comparator.

Reset fault	This bit is used to reset the aforementioned faults/errors.
Reset latch function	This bit is used to reset the latch function.
Load reference value 2	This bit is used to start transmitting the preset count (from bytes 0 to 3) to comparator 2.
Load reference value 1	This bit is used to start transmitting the preset count (from bytes 0 to 3) to comparator 1.

• To change the configuration of the Encoder_SSI acquisition module it is possible to proceed in two different ways:

Info Extended General	
Diagnostic alarm	
Gray-/Dual Converter	Gray 🗸
Encoder type	SSI 15 Bits 🗸
Total steps of absolut encoder	32768
Number of trailing bits	0
Parity	None 🗸
Repetition	Inactive ~
Baud rate	125 kHz 🗸
Monoflop time	32 µs 🗸
Comparator 1	Inactive ~
Comparator 2	Inactive ~
Scaling	
Reversal of rotational direction	
Latch	Inactive ~

- 1. Through ToolBOX:
 - a. Create a project with all the I/O modules that are present.
 - b. Enter the configuration tab of the SSI module and customize it:
 - i. Saving the file EDS --> import it in CODESYS
 - ii. Saving in the CANopen coupler the configuration just done



2. Through SDO:

at the end of the module initialization phase it is possible, in CODESYS, to download a list of parameters in the node through SDO. Thanks to this procedure it is possible to modify the SSI board setting.

15	16#3001:16#01	Module Slot 1 Parameter 1	1	8
16	16#3001:16#02	Module Slot 1 Parameter 2	13	8
17	16#3001:16#03	Module Slot 1 Parameter 3	8192	32
18	16#3001:16#04	Module Slot 1 Parameter 4	0	8
19	16#3001:16#05	Module Slot 1 Parameter 5	1	8
20	16#3001:16#06	Module Slot 1 Parameter 6	17	8
21	16#3001:16#07	Module Slot 1 Parameter 7	129	8

To understand how to set the various configuration parameters, refer to the following table:

Byte	7	6	5	4	3	2	1	0	1
0			Operating mode						
1	Encoder value coding			Enco	der value bit	t width			16#3001.2
2-5			То	tal number	of encoder s	steps			16#3001.3
6	Mult transm	tiple Mission	Par	ity	N	umber of appe	nded bits		16#3001.4
7		Baud	l rate		Monostak	ole multivibra	ator time p	eriod	16#3001.5
8		Comparat	or 2 mode			Comparator	1 mode		16#3001.6
9	Diagnosi s alarm	Reserved	Reserved	Reserved	Normaliza tion	Direction reversal	Lat	ch	16#3001.7
Opera Encod Encod Total Multij Parity Numb Baud Mono	ating mode der value c der value b number of ple transm v bit ver of appe rate/Clock	oding it width `encoder sta ission nded bits frequency tivibrator ti	$\frac{1 = Op}{0 = Gra}$ $\frac{0 = No}{8 = 8 b}$ $\frac{0 = No}{1 - 3 = 1}$ $\frac{0 = No}{0 \text{ bits}}$ $\frac{0 = 122}{4 = 1.5}$ inne period	$\frac{1 = \text{Operating mode 1}}{0 = \text{Gray code}; 1 = \text{Natural binary code}}$ $\frac{0 = \text{No encoder}}{8 = 8 \text{ bits } / 9 = 9 \text{ bits } //15 = 15 \text{ bits} / / 31 = 31 \text{ bits (with no parity bit)}}$ $\frac{0 = \text{No encoder}}{1 - 2^{3}1}; (16,, 32768,, 2147483648)$ $\frac{0 = \text{No multiple transmission}}{1 - 3 = \text{Multiple transmission}}$ $1 - 3 = \text{Multiple transmission with 1-3 idle cycles}$ $\frac{0 = \text{None}; 1 = \text{Odd}; 2 = \text{Even}}{0 \text{ bits} - 15 \text{ bits}}$ $\frac{0 = 125 \text{ kHz}; 1 = 250 \text{ kHz}; 2 = 500 \text{ kHz}; 3 = 1 \text{ MHz};$ $4 = 1.5 \text{ MHz}; 5 = 2 \text{ MHz}$ $me period 0 = 16 \mu\text{s}; \frac{1 = 32 \mu\text{s}}; 2 = 48 \mu\text{s}; 3 = 64 \mu\text{s}}$					urity bit)
Comp Diagr	arator $1/2 \mod e$ $0 = \text{Disabled}; 1 =$ osis alarm $0 = \text{Disabled}; 1 =$			Forward direo Enabled	etion; $2 = \text{Rev}$	erse directio	on; 3 = B	oth	
Norm	alization $\underline{0 = \text{Disabled}}; 1 =$			Enabled					
Direc	tion revers	sal	0 = Dis	sabled; $1 =$	Enabled				
Latch			$\frac{0 = \text{Dis}}{2 = \text{Fal}}$	<u>abled</u> ; 1 = 1 ling edge a	Rising edge a t DI; 3 = Botl	t DI; 1 edges at DI			

2.7. Troubleshooting

- 1. The position TPDO has not been sent:
 - a. Check that the PDO mapping is set to 255
 - b. Restore the default configuration of the TB20 Coupler Node through ToolBox

Info	Settings	
	Name: CANopen coupler	Save diagnostic
	Order number: 640-160-1AA11 Serial: 106296 HW revision: HW2-1	FW-Update
	FW-Version: 1.10.002 (CI-Version: 1.08.002	Restart
		Factory setting
	App state: Operational	Operational
	Node-ID: 1 CAN baud rate (Bit/s): 1000000	Preoperational
	Initialisation finished: Yes	SDO

- 2. The latch of the position doesn't work and/or the position comparator doesn't activates:
 - a. Check/modify the Module default settings

Info Extended General	
Diagnostic alarm	
Gray-/Dual Converter	Gray 🗸
Encoder type	SSI 15 Bits 🗸
Total steps of absolut encoder	32768
Number of trailing bits	0
Parity	None 🗸
Repetition	Inactive ~
Baud rate	125 kHz 🗸
Monoflop time	32 µs 🗸
Comparator 1	Inactive ~
Comparator 2	Inactive ~
Scaling	
Reversal of rotational direction	
Latch	Inactive ~

3. The encoder SSI of Eltra provides an input to reset the position. When the reset is made through this encoder input, the SSI acquiring module returns an error (probably due to a position "gap"). The error status of the module can be reset through the bit 7 of the CAN cell 16#2201.2.
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