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Datasheet

WTC6 IO60

Input and output module designed for use in wind turbines both onshore and offshore. It is designed to tolerate the high levels of vibration and EMC disturbances found in a wind turbine.

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Contents

1 Introduction

The IO60 is an input and output module designed for use in the harsh environment of a wind turbine. It have interfaces for all input and output types typically found in wind turbines, and is designed to tolerate the high levels of vibration and EMC disturbances found in a wind turbine.
The module is part of the sixth generation control system for wind turbines developed by KK Wind Solutions, known as WTC6. It can be used together with the other modules in the WTC6 series to create a complete control system, or it can be used with standard PLC systems, using the EtherCAT interface.
The module has an interface for controlling the modules in the third generation control system by KK Wind Solutions, known as WTC3, thus enabling the WTC3 modules to be used with the WTC6 control system or standard PLC systems.
All input signals and status of outputs is available via the EtherCAT network interface. Digital and analogue outputs and the communication interfaces are controlled from the EtherCAT master. Parameters for operation are set up from EtherCAT.

1.1 Part numbers

This datasheet covers the following part numbers.

IO60-1.13..... : Standard edition, version 1.13.

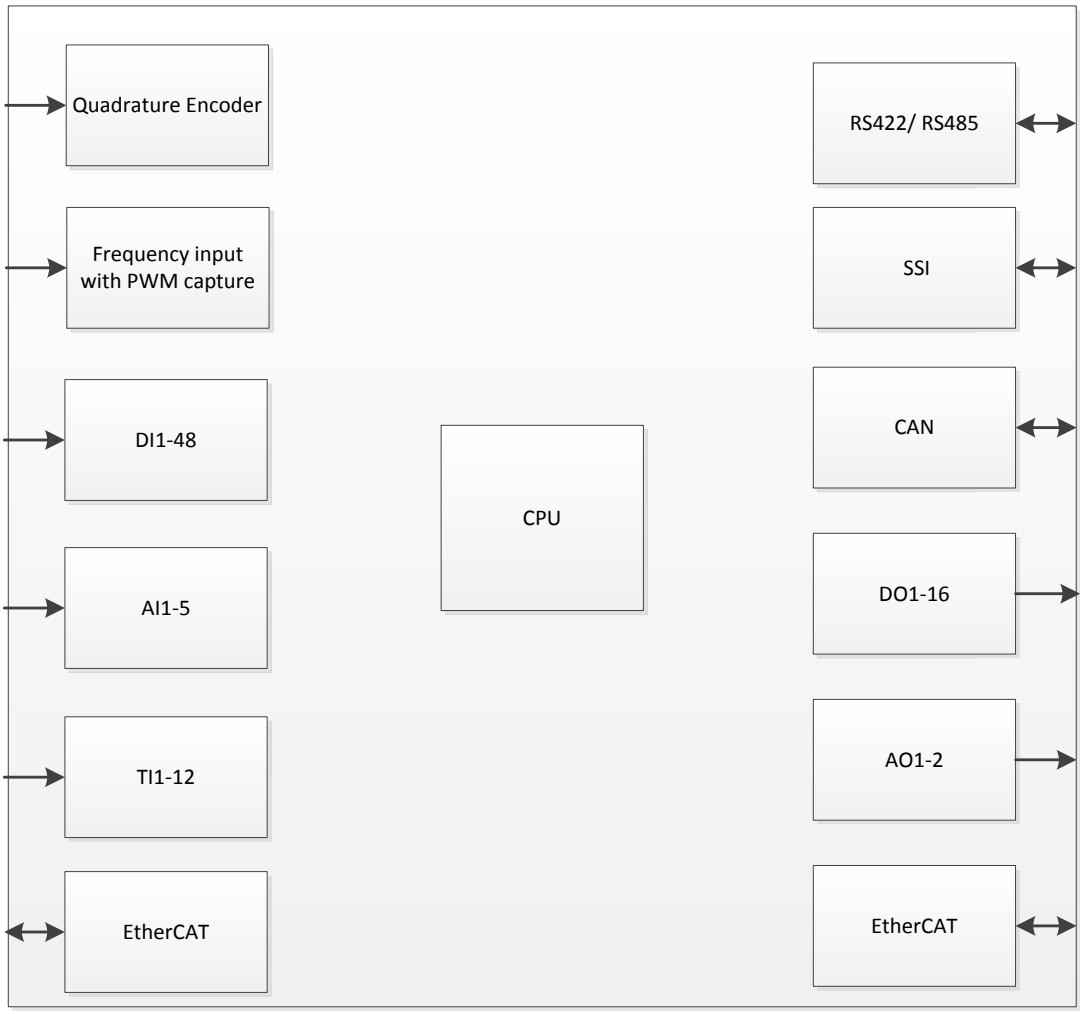
2 Important note

ESD (Electro Static Discharge) sensitive devices on Printed Circuit Board. Take the necessary precautions when working on ESD sensitive parts.

3 Features

- CAN master interface for KK Wind Solutions WTC3 modules, or CAN-EtherCAT modular device profile 5000 for e.g. CANopen.
- 48 digital inputs, for general purpose use
- 16 digital outputs, for general purpose use
- 2 analogue current outputs
- 5 analogue current inputs
- Incremental encoder input
- 12 temperature inputs
- 3 Frequency Inputs
- SSI interface
- RS485 / RS422 interface
- Separate DC supply input for digital output and analogue current output
- Temperature range -35 °C to 70 °C
- 2 Optical EtherCAT slave interfaces

3.1 Block diagram



4 Environmental data

4.1 Temperature

Operating temperature range..... : -35..70°C
Storage temperature range ..... : -40..70°C

4.2 Humidity

Operating humidity range..... : 5 - 95 %RH non condensing
Storage humidity range..... : 5 - 95 %RH non condensing

5 Interfaces

5.1 Digital inputs

The IO60 module can have up to 48 digital inputs. Some of these are multiplexed with other input types. The multiplexing can be seen below:

DI	*Connector*	*Alternative function*
1..3	X6	Frequency input (1 Frequency input uses 1 DI channel)
4..6	X6	None
7..12	X7	Increment encoder input (1 Encoder input uses 6 DI channels)
13..48	X16..X27	Temperature input (1 temperature input uses 3 DI channels)

The following data applies to all digital input regardless of the alternative function.

Input type ..... : Active high
Input resistance..... : 2 kΩ
High level..... : > 15 V, Max 30 V
Low level ..... : < 5.0 V, Min 0 V
Input filter bandwidth typical .. : 20 kHz

5.2 X1 & X2 - EtherCAT fibre communication

Speed ..... : 100 Mbit/s
Fibre ..... : Multimode
TX level minimum ..... : -20 dBm
RX sensitivity ..... : -31 dBm
Connector type ..... : SC fibre socked
Correspond to ..... : SC fibre plug

Pins	*Value*	*Function*
X1	RX	Fibre pair 1 RX
X2	TX	Fibre pair 1 TX

5.3 X3 & X4 - EtherCAT fibre communication

Speed ..... : 100 Mbit/s
Fibre ..... : Multimode
TX level minimum ..... : -20 dBm
RX sensitivity ..... : -31 dBm
Connector type ..... : SC fibre socked
Correspond to ..... : SC fibre plug

Pins	*Value*	*Function*
X3	RX	Fibre pair 2 RX
X4	TX	Fibre pair 2 TX

5.4 X5 - RS422/RS485/SSI

The IO60 have a multipurpose serial connection. This can be used for SSI connection to an absolute encoder or to RS422 / RS485 connections.
When using the serial connection, it should be set up to the correct connection and format. See Serial Settings register, RS4XX Settings and SSI Settings in the object dictionary.

RS4XX baud rate..... : 2400, 4800, 9600, 19200, 38400, 57600, 115200
RS4XX data frame format..... : 7E1, 7O1, 8N1, 8E1, 8O1, 7E2, 7O2, 8N2, 8E2, 8O2
SSI clock frequency..... : 125 kHz or 250 kHz
SSI pause time ..... : 55..50000 us
SSI data coding ..... : Grey or Binary
SSI data length..... : 7..31
Connector type..... : WAGO 231-135
Correspond to ..... : WAGO 231-105/026-000 & WAGO 231-2105

Pins	*Value*	*Function*
1	GND	GND
2	TX	IO60 Transmit / SSI clock
3	RX	IO60 Receive / SSI data
4	TX#	IO60 Transmit inverted / SSI clock inverted
5	RX#	IO60 Receive inverted/ SSI data inverted

5.5 X6 - Digital & frequency input

The IO60 have 3 digital inputs which can also be used as frequency inputs.

Frequency input duty cycle..... : 1..99 %
Frequency input range..... : 0.1 Hz..1 kHz
Frequency input accuracy..... : 0.01 %
Connector type..... : WAGO 231-137
Correspond to ..... : WAGO 231-107/026-000

Pins	*Value*	*Function*
1	GND	GND
2	DI1/FI1	Digital- / Frequency input 1
3	DI2/FI2	Digital- / Frequency input 2
4	DI3/FI3	Digital- / Frequency input 3
5	DI4	Digital input 4
6	DI5	Digital input 5
7	DI6	Digital input 6

5.6 X7 - Digital & incremental encoder input

The IO60 has an input for incremental encoders and proximity switches. If proximity switches are used the A and B signal must be phase angled 90°, in order to form a valid quadrature signal. The incremental encoders and proximity switches can be installed as either differential or single ended. The number of pulses per revolution should be set in the Encoder Settings entry in the object dictionary.

Encoder signals..... : A, A#, B, B#, Z, Z#
Encoder max frequency ..... : 85 kHz
Encoder accuracy ..... : 0.12% FS
Encoder high level (A-A#, B-B#, Z-Z#) ... : > -0.2 V, Max 30 V
Encoder low level (A-A#, B-B#, Z-Z#) .... : < -1.0 V, Min -30 V
Connector type..... : WAGO 231-137
Correspond to ..... : WAGO 231-107/026-000

Pins	*Value*	*Function*
1	GND	GND
2	DI7/ENCA	Digital input 7 / Encoder A
3	DI8/ENCA#	Digital input 8 / Encoder A#
4	DI9/ENCB	Digital input 9 / Encoder B
5	DI10/ENCB#	Digital input 10 / Encoder B#
6	DI11/ENCZ	Digital input 11 / Encoder Z
7	DI12/ENCZ#	Digital input 12 / Encoder Z#

5.7 X8..X11 - Digital Output

The 16 digital outputs are split into 4 groups with individual connector and power supply.

Output supply in connector ..... : 18..28 VDC
DO type ..... : High side solid state
Max inrush current..... : 70 A (0.15 J) per group @ RG=0.1 Ω, VG=24 V[1]
Output resistance..... : < 100 mΩ
Voltage drop max ..... : 3 V
Max load per channel ..... : 3 A
Max load per group (connector)..... : 4 A
Recommended fuse per group ..... : 10 A C-characteristic
Load monitoring range..... : 0..4 A ± 10% Full scale
Thermal protection ..... : Tj. 150 °C
Connector type..... : WAGO 231-135
Correspond to ..... : WAGO 231-105/026-000

5.7.1 X8 - DO1..4

Pins	*Value*	*Function*
1	DO1	Digital output 1
2	DO2	Digital output 2
3	DO3	Digital output 3
4	DO4	Digital output 4
5	DO_Supply	DO Group supply 18-28V

5.7.2 X9 - DO5..8

Pins	*Value*	*Function*
1	DO5	Digital output 5
2	DO6	Digital output 6
3	DO7	Digital output 7
4	DO8	Digital output 8
5	DO_Supply	DO Group supply 18-28V

5.7.3 X10 - DO9..12

Pins	*Value*	*Function*
1	DO9	Digital output 9
2	DO10	Digital output 10
3	DO11	Digital output 11
4	DO12	Digital output 12
5	DO_Supply	DO Group supply 18-28V

[1] The Inrush current is defined as the maximum current that runs into the connector when having 0.1Ω series resistance at the rated voltage.

5.7.4 X11 - DO13..16

Pins	*Value*	*Function*
1	DO13	Digital output 13
2	DO14	Digital output 14
3	DO15	Digital output 15
4	DO16	Digital output 16 (WTC3 modules power enable)
5	DO_Supply	DO Group supply 18-28V

5.8 X12 - Analogue input

Input range..... : 4..20 mA
Accuracy..... : ± 0.5 % full scale
Connector type..... : WAGO 231-136
Correspond to ..... : WAGO 231-106/026-000

Pins	*Value*	*Function*
1	GND	GND
2	AI1	Analogue current input 1
3	AI2	Analogue current input 2
4	AI3	Analogue current input 3
5	AI4	Analogue current input 4
6	AI5	Analogue current input 5

5.9 X13 - Analogue output

Output Supply in connector..... : 18..28 VDC
Recommended fuse ..... : 6 A C-characteristic
Output range..... : 4..20 mA
Max sink resistance..... : 600 Ω
Accuracy ..... : +- 0,5 % full scale
Connector type..... : WAGO 231-134
Correspond to ..... : WAGO 231-104/026-000

Pins	*Value*	*Function*
1	GND	GND
2	AO1	Analogue current output 1
3	AO2	Analogue current output 2
4	AO_Supply	AO supply 18..28V

5.10 X14 - Power supply

Input voltage ..... : 18..56 VDC
Power consumption max ..... : 10 W
Recommended fuse ..... : 6 A C-characteristic
Max inrush current..... : 15 A (0.02 J) @ RG=0.1 Ω, VG=48 V[2]
Connector type..... : WAGO 231-132
Correspond to ..... : WAGO 231-102/026-000

Pins	*Value*	*Function*
1	GND	GND
2	Supply	Module supply 18..56 V

[2] The Inrush current is defined as the maximum current that runs into the connector when having 0.1Ω series resistance at the rated voltage.

5.11 X15 - CAN bus

The CAN connector on the IO60 module can be used for either connection KK Wind Solutions WTC3 modules or as a distributed generic CAN port which can be used for multiple protocols (e.g. CANopen). The generic CAN port uses the modular device profile 5000 as specified in the EtherCAT standard. The connection type can be set using the CAN Settings object in the object dictionary. Note that when selecting to use the CAN port for WTC3 modules, the output DO16 is used for WTC3 module power control. This means that DO16 cannot be controlled as a DO, when using the can port for WTC3 modules.

Bus specification ..... : CAN 2.0B
Bus impedance..... : 120 Ω
Termination..... : 120 Ω (Must be applied externally at end points)
Connector type..... : WAGO 231-134
Correspond to ..... : WAGO 231-104/026-000 or WAGO 231-2104

Pins	***Value***	***Function***
1	GND	GND
2	SHLD	Shield
3	CAN HI	CAN high
4	CAN LO	CAN low

5.11.1 CAN setup

When using the IO60 with WTC3 modules, the CAN bitrate is set up by the rotate switch ‘CAN BIT’.

CAN BIT	CAN bitrate
0	125kBit
1	250kBit
2	500kBit
3	1MBit

5.12 X16..X27 - Temperature & digital inputs

The IO60 have 12 temperature inputs which alternatively can be used as digital inputs. 3 Digital inputs per temperature input channel. Temperature sensors can be directly connected to the IO60. The IO60 supports both 2 wire and 3 wire sensor solutions.

Input type ..... : 2 or 3 wire PT-100
Measurement range ..... : -45°C..+195°C
Accuracy ..... : ±0.5 % full scale
Connector type..... : WAGO 231-133
Correspond to ..... : WAGO 231-103/026-000

5.12.1 X16 - TI1 / DI13..15

Pins	*Value*	*Function*
1	TI1-A1	PT-100 current sink / measurement point
	DI13	Digital input 13
2	TI1-A2	PT-100 measurement point
	DI14	Digital input 14
3	TI1-B	PT-100 ground and measurement point
	DI15	Digital input 15

5.12.2 X17 - TI2 / DI16..18

Pins	*Value*	*Function*
1	TI2-A1	PT-100 current sink / measurement point
	DI16	Digital input 16
2	TI2-A2	PT-100 measurement point
	DI17	Digital input 17
3	TI2-B	PT-100 ground and measurement point
	DI18	Digital input 18

5.12.3 X18 - TI3 / DI19..21

Pins	*Value*	*Function*
1	TI3-A1	PT-100 current sink / measurement point
	DI19	Digital input 19
2	TI3-A2	PT-100 measurement point
	DI20	Digital input 20
3	TI3-B	PT-100 ground and measurement point
	DI21	Digital input 21

5.12.4 X19 - TI4 / DI22..24

Pins	*Value*	*Function*
1	TI4-A1	PT-100 current sink / measurement point
	DI22	Digital input 22
2	TI4-A2	PT-100 measurement point
	DI23	Digital input 23
3	TI4-B	PT-100 ground and measurement point
	DI24	Digital input 24

5.12.5 X20 - TI5 / DI25..27

Pins	*Value*	*Function*
1	TI5-A1	PT-100 current sink / measurement point
	DI25	Digital input 25
2	TI5-A2	PT-100 measurement point
	DI26	Digital input 26
3	TI5-B	PT-100 ground and measurement point
	DI27	Digital input 27

5.12.6 X21 - TI6 / DI28..30

Pins	*Value*	*Function*
1	TI6-A1	PT-100 current sink / measurement point
	DI28	Digital input 28
2	TI6-A2	PT-100 measurement point
	DI29	Digital input 29
3	TI6-B	PT-100 ground and measurement point
	DI30	Digital input 30

5.12.7 X22 - TI7 / DI31..33

Pins	*Value*	*Function*
1	TI7-A1	PT-100 current sink / measurement point
	DI31	Digital input 31
2	TI7-A2	PT-100 measurement point
	DI32	Digital input 32
3	TI7-B	PT-100 ground and measurement point
	DI33	Digital input 33

5.12.8 X23 - TI8 / DI34..36

Pins	*Value*	*Function*
1	TI8-A1	PT-100 current sink / measurement point
	DI34	Digital input 34
2	TI8-A2	PT-100 measurement point
	DI35	Digital input 35
3	TI8-B	PT-100 ground and measurement point
	DI36	Digital input 36

5.12.9 X24 - TI9 / DI37..39

Pins	*Value*	*Function*
1	TI9-A1	PT-100 current sink / measurement point
	DI37	Digital input 37
2	TI9-A2	PT-100 measurement point
	DI38	Digital input 38
3	TI9-B	PT-100 ground and measurement point
	DI39	Digital input 39

5.12.10 X25 - TI10 / DI40..42

Pins	*Value*	*Function*
1	TI10-A1	PT-100 current sink / measurement point
	DI40	Digital input 40
2	TI10-A2	PT-100 measurement point
	DI41	Digital input 41
3	TI10-B	PT-100 ground and measurement point
	DI42	Digital input 42

5.12.11 X26 - TI11 / DI43..45

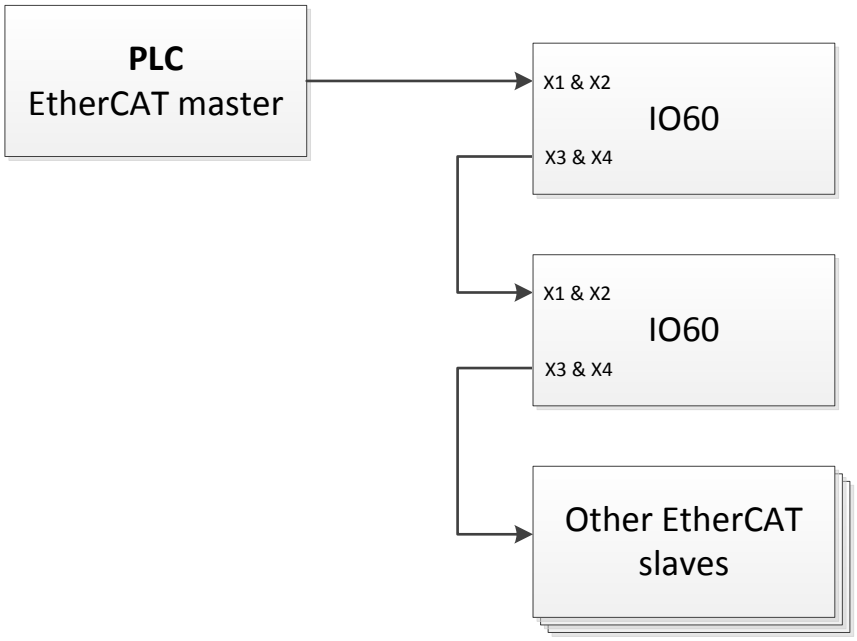
Pins	*Value*	*Function*
1	TI11-A1	PT-100 current sink / measurement point
	DI43	Digital input 43
2	TI11-A2	PT-100 measurement point
	DI44	Digital input 44
3	TI11-B	PT-100 ground and measurement point
	DI45	Digital input 45

5.12.12 X27 - TI12 / DI46..48

Pins	*Value*	*Function*
1	TI12-A1	PT-100 current sink / measurement point
	DI46	Digital input 46
2	TI12-A2	PT-100 measurement point
	DI47	Digital input 47
3	TI12-B	PT-100 ground and measurement point
	DI48	Digital input 48

6 EtherCAT Communication

The IO60 module is a standard EtherCAT slave module. It contains two EtherCAT connectors which makes it possible to daisy chain IO60 modules, as can be seen below:



The IO60 supports the EtherCAT CoE (CANopen over EtherCAT) standard for asynchronous communication, which is typically used for module setup during initialization, but also used for retrieving non process data, such as a module event log. The IO60 also supports the EtherCAT FoE (File over EtherCAT) standard which can be used for updating the firmware of the IO60.

6.1 Object dictionary

The object dictionary defines the communication objects available on the IO60 module over EtherCAT. Each communication object is identified by an index and a sub-index value.

6.1.1 Identity and communication configuration

Index	Name	Data Type	Access	Description
0x1000	Device type	UINT32	R	0
0x1001	Error Register	RECORD		
.0	generic error	BOOLEAN	R	
.1	current error	BOOLEAN	R	
.2	voltage error	BOOLEAN	R	
.3	temperature error	BOOLEAN	R	
.4	communication error	BOOLEAN	R	
.5	device profile specific error	BOOLEAN	R	
.6	reserved	BOOLEAN	R	
.7	manufacturer specific error	BOOLEAN	R	
0x1008	Device name	String	R	“IO60”
0x1009	HW Version	String	R	“HW version”
0x100A	SW Version	String	R	“Date for SW”
0x1018	Identity	RECORD		
.0	No of entries	UNSIGNED8	R	4
.1	Vendor ID	UNSIGNED32	R	0x00AE4B4B
.2	Product code	UNSIGNED32	R	0x00000005
.3	Revision	UNSIGNED32	R	SW revision
.4	Serial number	UNSIGNED32	R	Module serial nr
0x1600	Receive PDO Mapping 0	RECORD		
.0	No of entries	UNSIGNED8	R	1
.1	DO RxPDO-Map	UINT32	R	Subindexs 0x7000
0x1601	Receive PDO Mapping 1	RECORD		
.0	No of entries	UNSIGNED8	R	1
.1	AO RxPDO-Map	UINT32	R	Subindexs 0x7001
0x1602	Receive PDO Mapping 2	RECORD		
.0	No of entries	UNSIGNED8	R	1
.1	RS4xx TX RxPDO-Map	UINT32	R	Subindexs 0x7010
0x1A00	Transmit PDO Mapping 0	RECORD		
.0	No of entries	UNSIGNED8	R	1
.1	DI TxPDO-Map	UINT32	R	Subindexs 0x6000
0x1A01	Transmit PDO Mapping 1	RECORD		
.0	No of entries	UNSIGNED8	R	1
.1	DO Status TxPDO-Map	UINT32	R	Subindexs 0x6001
0x1A02	Transmit PDO Mapping 2	RECORD		
.0	No of entries	UNSIGNED8	R	1
.1	DO Current TxPDO-Map	UINT32	R	Subindexs 0x6002
0x1A03	Transmit PDO Mapping 3	RECORD		
.0	No of entries	UNSIGNED8	R	1
.1	AO Status TxPDO-Map	UINT32	R	Subindexs 0x6003
0x1A04	Transmit PDO Mapping 4	RECORD		
.0	No of entries	UNSIGNED8	R	1

Index	Name	Data Type	Access	Description
.1	TI TxPDO-Map	UINT32	R	Subindexs 0x6004
0x1A05	Transmit PDO Mapping 5	RECORD		
.0	No of entries	UNSIGNED8	R	1
.1	TI Status TxPDO-Map	UINT32	R	Subindexs 0x6005
0x1A06	Transmit PDO Mapping 6	RECORD		
.0	No of entries	UNSIGNED8	R	1
.1	AI TxPDO-Map	UINT32	R	Subindexs 0x6006
0x1A07	Transmit PDO Mapping 7			
.0	No of entries	UNSIGNED8	R	1
.1	AI Status TxPDO-Map	UINT32	R	Subindexs 0x6007
0x1A08	Transmit PDO Mapping 8	RECORD		
.0	No of entries	UNSIGNED8	R	1
.1	Encoder TxPDO-Map	UINT32	R	Subindexs 0x6008
0x1A09	Transmit PDO Mapping 9	RECORD		
.0	No of entries	UNSIGNED8	R	1
.1	Frequency Input TxPDO-Map	UINT32	R	Subindexs 0x6009
0x1A0A	Transmit PDO Mapping 10	RECORD		
.0	No of entries	UNSIGNED8	R	1
.1	Duty Cycle Capture TxPDO-Map	UINT32	R	Subindexs 0x600A
0x1A0B	Transmit PDO Mapping 11	RECORD		
.0	No of entries	UNSIGNED8	R	1
.1	Supply Voltage TxPDO-Map	UINT32	R	Subindexs 0x6020
0x1A0C	Transmit PDO Mapping 12	RECORD		
.0	No of entries	UNSIGNED8	R	1
.1	Internal Temperature TxPDO-Map	UINT32	R	Subindexs 0x6021
0x1A0D	Transmit PDO Mapping 13	RECORD		
.0	No of entries	UNSIGNED8	R	1
.1	RS4xx RX TxPDO-Map	UINT32	R	Subindexs 0x6030
0x1A0E	Transmit PDO Mapping 14	RECORD		
.0	No of entries	UNSIGNED8	R	1
.1	SSI TxPDO-Map	UINT32	R	Subindexs 0x6031

6.1.2 Inputs

Index	Name	Data Type	Access	Description
0X6000	DI	RECORD		
.0	No of entries	UNSIGNED8	R	48
.1	DI1	BOOLEAN	R	
.2	DI2	BOOLEAN	R	
.3	DI3	BOOLEAN	R	
.4	DI4	BOOLEAN	R	
.5	DI5	BOOLEAN	R	
.6	DI6	BOOLEAN	R	
.7	DI7	BOOLEAN	R	
.8	DI8	BOOLEAN	R	
.9	DI9	BOOLEAN	R	
.10	DI10	BOOLEAN	R	
.11	DI11	BOOLEAN	R	
.12	DI12	BOOLEAN	R	
.13	DI13	BOOLEAN	R	
.14	DI14	BOOLEAN	R	
.15	DI15	BOOLEAN	R	
.16	DI16	BOOLEAN	R	
.17	DI17	BOOLEAN	R	
.18	DI18	BOOLEAN	R	
.19	DI19	BOOLEAN	R	
.20	DI20	BOOLEAN	R	
.21	DI21	BOOLEAN	R	
.22	DI22	BOOLEAN	R	
.23	DI23	BOOLEAN	R	
.24	DI24	BOOLEAN	R	
.25	DI25	BOOLEAN	R	
.26	DI26	BOOLEAN	R	
.27	DI27	BOOLEAN	R	
.28	DI28	BOOLEAN	R	
.29	DI29	BOOLEAN	R	
.30	DI30	BOOLEAN	R	
.31	DI31	BOOLEAN	R	
.32	DI32	BOOLEAN	R	
.33	DI33	BOOLEAN	R	
.34	DI34	BOOLEAN	R	
.35	DI35	BOOLEAN	R	
.36	DI36	BOOLEAN	R	
.37	DI37	BOOLEAN	R	
.38	DI38	BOOLEAN	R	
.39	DI39	BOOLEAN	R	
.40	DI40	BOOLEAN	R	
.41	DI41	BOOLEAN	R	
.42	DI42	BOOLEAN	R	
.43	DI43	BOOLEAN	R	
.44	DI44	BOOLEAN	R	
.45	DI45	BOOLEAN	R	

Index	Name	Data Type	Access	Description
.46	DI46	BOOLEAN	R	
.47	DI47	BOOLEAN	R	
.48	DI48	BOOLEAN	R	
0X6001	DO Status	RECORD		
.0	No of entries	UNSIGNED8	R	16
.1	DO1	BOOLEAN	R	
.2	DO2	BOOLEAN	R	
.3	DO3	BOOLEAN	R	
.4	DO4	BOOLEAN	R	
.5	DO5	BOOLEAN	R	
.6	DO6	BOOLEAN	R	
.7	DO7	BOOLEAN	R	
.8	DO8	BOOLEAN	R	
.9	DO9	BOOLEAN	R	
.10	DO10	BOOLEAN	R	
.11	DO11	BOOLEAN	R	
.12	DO12	BOOLEAN	R	
.13	DO13	BOOLEAN	R	
.14	DO14	BOOLEAN	R	
.15	DO15	BOOLEAN	R	
.16	DO16	BOOLEAN	R	
0X6002	DO Current	RECORD		
.0	No of entries	UNSIGNED8	R	16
.1	DO1	REAL32	R	
.2	DO2	REAL32	R	
.3	DO3	REAL32	R	
.4	DO4	REAL32	R	
.5	DO5	REAL32	R	
.6	DO6	REAL32	R	
.7	DO7	REAL32	R	
.8	DO8	REAL32	R	
.9	DO9	REAL32	R	
.10	DO10	REAL32	R	
.11	DO11	REAL32	R	
.12	DO12	REAL32	R	
.13	DO13	REAL32	R	
.14	DO14	REAL32	R	
.15	DO15	REAL32	R	
.16	DO16	REAL32	R	
0X6003	AO Status	RECORD		
.0	No of entries	UNSIGNED8	R	3
.1	AO1	BOOLEAN	R	
.2	AO2	BOOLEAN	R	
0X6004	TI	RECORD		
.0	No of entries	UNSIGNED8	R	12
.1	TI1	REAL32	R	
.2	TI2	REAL32	R	
.3	TI3	REAL32	R	
.4	TI4	REAL32	R	

Index	Name	Data Type	Access	Description
.5	TI5	REAL32	R	
.6	TI6	REAL32	R	
.7	TI7	REAL32	R	
.8	TI8	REAL32	R	
.9	TI9	REAL32	R	
.10	TI10	REAL32	R	
.11	TI11	REAL32	R	
.12	TI12	REAL32	R	
0X6005	TI Status	RECORD		
.0	No of entries	UNSIGNED8	R	13
.1	TI1	BOOLEAN	R	
.2	TI2	BOOLEAN	R	
.3	TI3	BOOLEAN	R	
.4	TI4	BOOLEAN	R	
.5	TI5	BOOLEAN	R	
.6	TI6	BOOLEAN	R	
.7	TI7	BOOLEAN	R	
.8	TI8	BOOLEAN	R	
.9	TI9	BOOLEAN	R	
.10	TI10	BOOLEAN	R	
.11	TI11	BOOLEAN	R	
.12	TI12	BOOLEAN	R	
0X6006	AI	RECORD		
.0	No of entries	UNSIGNED8	R	5
.1	AI1	REAL32	R	
.2	AI2	REAL32	R	
.3	AI3	REAL32	R	
.4	AI4	REAL32	R	
.5	AI5	REAL32	R	
0X6007	AI Status	RECORD		
.0	No of entries	UNSIGNED8	R	5
.1	AI1	BOOLEAN	R	
.2	AI2	BOOLEAN	R	
.3	AI3	BOOLEAN	R	
.4	AI4	BOOLEAN	R	
.5	AI5	BOOLEAN	R	
0X6008	Encoder	RECORD		
.0	No of entries	UNSIGNED8	R	5
.1	Velocity [RPM]	REAL32	R	
.2	Angle [deg]	REAL32	R	
.3	Index Angle [deg]	REAL32	R	
.4	Index Angle Status	UNSIGNED16	R	
.5	Pulse Per Rev Status	UNSIGNED16	R	
0X6009	Frequency Inputs	RECORD		
.0	No of entries	UNSIGNED8	R	3
.1	FI1	REAL32	R	
.2	FI2	REAL32	R	
.3	FI3	REAL32	R	
0X600A	Duty Cycle Capture	RECORD		

Index	Name	Data Type	Access	Description
.0	No of entries	UNSIGNED8	R	3
.1	FI1	REAL32	R	
.2	FI2	REAL32	R	
.3	FI3	REAL32	R	
0X6020	Supply Voltage	RECORD		
.0	No of entries	UNSIGNED8	R	10
.1	Cpu Supply Voltage	REAL32	R	
.2	15V Supply Voltage	REAL32	R	
.3	-15V Supply Voltage	REAL32	R	
.4	Module Supply Voltage	REAL32	R	
.5	Capacitor Supply Voltage	REAL32	R	
.6	AO Supply Voltage	REAL32	R	
.7	DO 1-4 Supply voltage	REAL32	R	
.8	DO 5-8 Supply voltage	REAL32	R	
.9	DO 9-12 Supply voltage	REAL32	R	
.10	DO 13-16 Supply voltage	REAL32	R	
0X6021	Internal Temperature	RECORD		
.0	No of entries	UNSIGNED8	R	1
.1	Cpu Internal Temp	REAL32	R	
0X6030	RS4xx RX	RECORD		
.0	No of entries	UNSIGNED8	R	23
.1	Status	UNSIGNED16	R	
.2	Data In 0	UNSIGNED16	R	
.3	Data In 1	UNSIGNED16	R	
.4	Data In 2	UNSIGNED16	R	
.5	Data In 3	UNSIGNED16	R	
.6	Data In 4	UNSIGNED16	R	
.7	Data In 5	UNSIGNED16	R	
.8	Data In 6	UNSIGNED16	R	
.9	Data In 7	UNSIGNED16	R	
.10	Data In 8	UNSIGNED16	R	
.11	Data In 9	UNSIGNED16	R	
.12	Data In 10	UNSIGNED16	R	
.13	Data In 11	UNSIGNED16	R	
.14	Data In 12	UNSIGNED16	R	
.15	Data In 13	UNSIGNED16	R	
.16	Data In 14	UNSIGNED16	R	
.17	Data In 15	UNSIGNED16	R	
.18	Data In 16	UNSIGNED16	R	
.19	Data In 17	UNSIGNED16	R	
.20	Data In 18	UNSIGNED16	R	
.21	Data In 19	UNSIGNED16	R	
.22	Data In 20	UNSIGNED16	R	
.23	Data In 21	UNSIGNED16	R	
0X6031	SSI	RECORD		
.0	No of entries	UNSIGNED8	R	3
.1	Status	UNSIGNED16	R	
.3	Data	UNSIGNED32	R	

6.1.3 Outputs

Index	Name	Data Type	Access	Description
0X7000	DO	RECORD		
.0	No of entries	UNSIGNED8	R	16
.1	DO1	BOOLEAN	RW	
.2	DO2	BOOLEAN	RW	
.3	DO3	BOOLEAN	RW	
.4	DO4	BOOLEAN	RW	
.5	DO5	BOOLEAN	RW	
.6	DO6	BOOLEAN	RW	
.7	DO7	BOOLEAN	RW	
.8	DO8	BOOLEAN	RW	
.9	DO9	BOOLEAN	RW	
.10	DO10	BOOLEAN	RW	
.11	DO11	BOOLEAN	RW	
.12	DO12	BOOLEAN	RW	
.13	DO13	BOOLEAN	RW	
.14	DO14	BOOLEAN	RW	
.15	DO15	BOOLEAN	RW	
.16	DO16	BOOLEAN	RW	
0X7001	AO	RECORD		
.0	No of entries	UNSIGNED8	R	2
.1	AO1	REAL32	RW	
.2	AO2	REAL32	RW	
0X7010	RS4xx TX	RECORD		
.0	No of entries	UNSIGNED8	R	23
.1	Control	UNSIGNED16	RW	
.2	Data Out 0	UNSIGNED8	RW	
.3	Data Out 1	UNSIGNED8	RW	
.4	Data Out 2	UNSIGNED8	RW	
.5	Data Out 3	UNSIGNED8	RW	
.6	Data Out 4	UNSIGNED8	RW	
.7	Data Out 5	UNSIGNED8	RW	
.8	Data Out 6	UNSIGNED8	RW	
.9	Data Out 7	UNSIGNED8	RW	
.10	Data Out 8	UNSIGNED8	RW	
.11	Data Out 9	UNSIGNED8	RW	
.12	Data Out 10	UNSIGNED8	RW	
.13	Data Out 11	UNSIGNED8	RW	
.14	Data Out 12	UNSIGNED8	RW	
.15	Data Out 13	UNSIGNED8	RW	
.16	Data Out 14	UNSIGNED8	RW	
.17	Data Out 15	UNSIGNED8	RW	
.18	Data Out 16	UNSIGNED8	RW	
.19	Data Out 17	UNSIGNED8	RW	
.20	Data Out 18	UNSIGNED8	RW	
.21	Data Out 19	UNSIGNED8	RW	
.22	Data Out 20	UNSIGNED8	RW	
.23	Data Out 21	UNSIGNED8	RW	

6.1.4 Settings

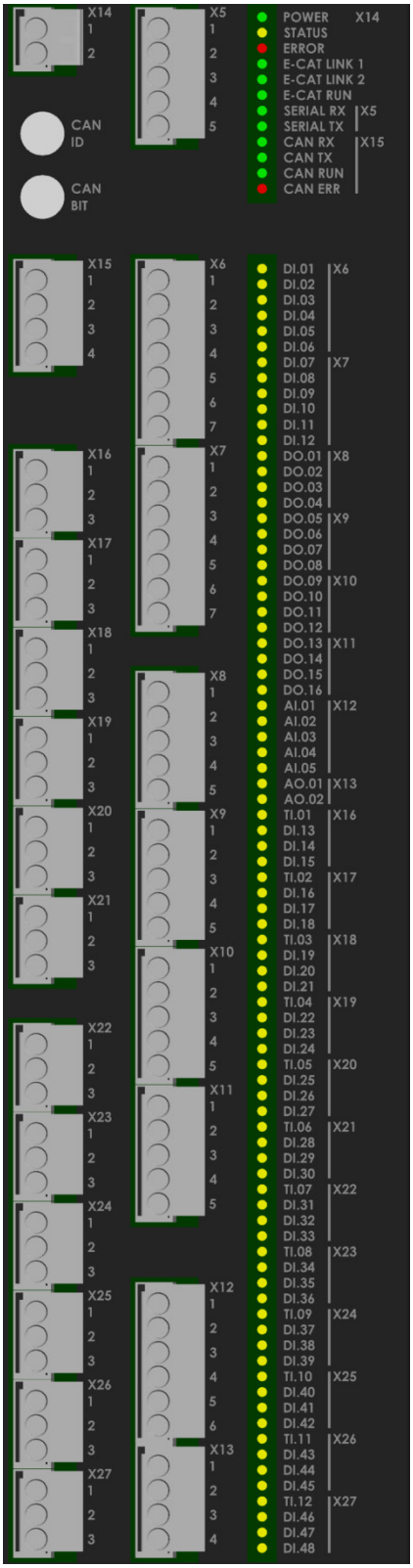
Index	Name	Data Type	Access	Description
0x8f02	DI FilterTime	RECORD		
.0	No of entries	UNSIGNED8	R	48
.1	DI1	float32	RW	
.2	DI2	float32	RW	
.3	DI3	float32	RW	
.4	DI4	float32	RW	
.5	DI5	float32	RW	
.6	DI6	float32	RW	
.7	DI7	float32	RW	
.8	DI8	float32	RW	
.9	DI9	float32	RW	
.10	DI10	float32	RW	
.11	DI11	float32	RW	
.12	DI12	float32	RW	
.13	DI13	float32	RW	
.14	DI14	float32	RW	
.15	DI15	float32	RW	
.16	DI16	float32	RW	
.17	DI17	float32	RW	
.18	DI18	float32	RW	
.19	DI19	float32	RW	
.20	DI20	float32	RW	
.21	DI21	float32	RW	
.22	DI22	float32	RW	
.23	DI23	float32	RW	
.24	DI24	float32	RW	
.25	DI25	float32	RW	
.26	DI26	float32	RW	
.27	DI27	float32	RW	
.28	DI28	float32	RW	
.29	DI29	float32	RW	
.30	DI30	float32	RW	
.31	DI31	float32	RW	
.32	DI32	float32	RW	
.33	DI33	float32	RW	
.34	DI34	float32	RW	
.35	DI35	float32	RW	
.36	DI36	float32	RW	
.37	DI37	float32	RW	
.38	DI38	float32	RW	
.39	DI39	float32	RW	
.40	DI40	float32	RW	
.41	DI41	float32	RW	
.42	DI42	float32	RW	
.43	DI43	float32	RW	
.44	DI44	float32	RW	
.45	DI45	float32	RW	

Index	Name	Data Type	Access	Description
.46	DI46	float32	RW	
.47	DI47	float32	RW	
.48	DI48	float32	RW	
0x8f03	Encoder Settings	RECORD		
.0	No of entries	UNSIGNED8	R	1
.1	Resolution [Pulses/Revolution]		RW	
0x8f04	Encoder Extended Info	RECORD		
.0	No of entries	UNSIGNED8	R	6
.1	Vel dPos	REAL32	R	
.2	Vel dTime	REAL32	R	
.3	Vel Auto	REAL32	R	
.4	Vel Method Used	UNSIGNED16	R	
.5	Index Error	INTEGER16	R	
.6	Current PPR	UNSIGNED16	R	
0x8f05	Serial Settings	RECORD		
.0	No of entries	UNSIGNED8	R	1
.1	Serial mode		RW	RS485 =1 RS422 =2 SSI =3
0x80a0	RS485 Test	RECORD		
.0	No of entries	UNSIGNED8	R	2
.1	RX	OCTETSTRING	R	
.2	TX	OCTETSTRING	RW	
0X8010	SSI Settings	RECORD		
.0	No of entries	UNSIGNED8	R	5
.1	Frame size		RW	
.2	Data length		RW	
.3	Baudrate		RW	
.4	Coding		RW	
.5	Pause time		RW	
0x8023	Cpu Internal Temp - CPU Manufacturer cal	RECORD		
.0	No of entries	UNSIGNED8	R	2
.1	Gain		R	
.2	Offset		R	
0X8011	RS4XX Settings	RECORD		
.0	No of entries	UNSIGNED8	R	2
.1	Baudrate		RW	2400 =1 4800 =2 9600 =3 19200 =4 38400 =5 57600 =6 115200 =7
.2	Data frame		RW	7E1 =1 7O1 =2 8N1 =3 8E1 =4 8O1 =5 7E2 =6 7O2 =7 8N2 =8 8E2 =9 8O2 =10
0X8012	Analogue output Current	RECORD		
.0	No of entries	UNSIGNED8	R	2

Index	Name	Data Type	Access	Description
.1	AO1	REAL32	R	
.2	AO2	REAL32	R	
0X807e	CAN settings	RECORD		
.0	No of entries	UNSIGNED8	R	3
.1	CAN Switch		RW	CANIF =1 CANkk = 2
.2	CANkk supply toggle-off time		RW	
.3	CANkk supply power-up time		RW	

7 LED Indicators

Information about the module status is indicated by several LEDs placed the module front.



LED	*Colour*	*Status*	*Means*
POWER	Green	ON	Supply input present
		OFF	Supply input missing
STATUS	Yellow	ON	
		BLINK[#2]	CPU Operating
		FLASH[#3]	Boot loader
		OFF	
ERROR	Red	ON	Module error
		OFF	OK
E-CAT LINK 1..2	Green	ON	Link OK
		BLINK[#2]	Link OK – Data transfer active
		OFF	No link
E-CAT RUN	Green	FLICK[#1]	Bootstrap
		ON	Operational
		FLASH[#3]	Safe-operational
		BLINK[#2]	Pre-operational
		OFF	Initialisation
SERIAL RX	Green	BLINK	Receiving serial data on RS4XX / SSI
SERIAL TX	Green	BLINK	Transmitting serial data on RS4XX / SSI
CAN RX	Green	BLINK	Receiving data on CAN bus
CAN TX	Green	BLINK	Transmitting data on CAN bus
CAN RUN (WTC3 CAN)	Green	ON	Communication OK
		BLINK[#2]	Communication error
		FLICK[#1]	Initializing communication
		OFF	No CAN devices found in scan
CAN RUN (ECAT CAN)	Green	-	Controlled by EtherCAT master
CAN ERR (WTC3 CAN)	Red	-	Not used
CAN ERR (ECAT CAN)	Red	-	Controlled by EtherCAT master
DI1..48	Yellow	ON	Input High
		OFF	Input Low
DO1..16	Yellow	ON	Output High
		OFF	Output Low
TI1..12	Green	ON	Valid PT-100 sensor
		OFF	Open circuited
		FLICK[#1]	Short circuited
AI1..5	Green	ON	Valid current input
		OFF	Below 3 mA
		FLICK[#1]	Above 21 mA
AO1..2	Green	ON	Output ON
		OFF	Below 3 mA
		FLICK[#1]	Above 21 mA

[#1] FLICK: 10 Hz, 50% duty cycle
[#2] BLINK: 2.5 Hz, 50% duty cycle
[#3] FLASH: 200 ms ON / 1000 ms OFF

Note: During boot, STATUS and ERROR LEDs are used to indicate boot program progress.

Note: When a TI input is used for DI, the TI LED could be flickering depending on the connected impedance

8 Standards

8.1 EMC standards

DS/EN 61000-6-4:2007.....: Electromagnetic compatibility - Generic emission standard – Part 6-4: Industrial environment.

DS/EN 61000-6-2:2005.....: Electromagnetic compatibility - Part 6-2: Generic standards – Immunity for industrial environment. **Improved immunity for ESD, Burst and Surge.**

8.2 Vibration

Vibration random.....: IEC 60068-2-64
Vibration sine.....: IEC 60068-2-6
Bump.....: IEC 60068-2-29
Shock.....: IEC 60068-2-27

9 Mechanical

9.1 Dimension and weight

Height.....: 240 mm
Width.....: 350 mm
Depth.....: 38.5 mm
Weight.....: 2.7 kg

10 MTTF

The IO60 module BOM has been calculated for a MTTF nr by TÜV Nord.

MTTF @ 25 °C.....: 40.3 years
MTTF @ 45 °C.....: 31.7 years
MTTF @ 70 °C.....: 14.0 years

The above numbers are based on use of all the IO60 functionality. If the module is only used partially, please contact KK Wind Solutions for calculations on partial module.

11 Application notes

11.1 Digital inputs

Passive and active digital inputs can be connected directly to the IO60 without additional relays. Further details can be found in Figure 1.

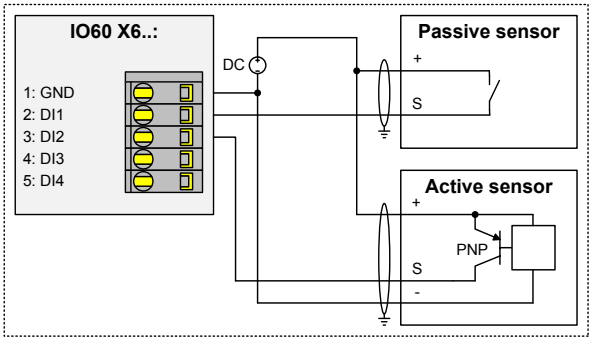


Figure 1: Digital input

The minimum switching capacity of the connected sensors should always be considered to avoid oxidation of the contact set. The IO60 draws 12mA at high level (input resistance 2kΩ).

11.2 RS422/RS485/SSI

For SSI or RS422, the serial connection should be connected at shown in Figure 2.

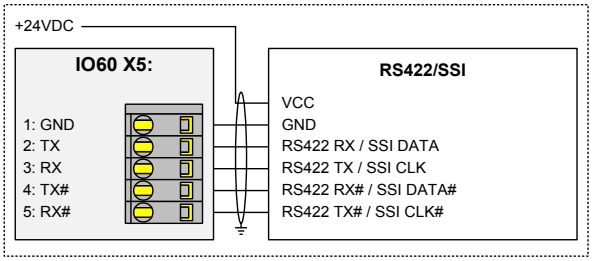


Figure 2: RS422 and SSI connection

When using RS485 the TX and RX signals (Pin 2 to 3) should be short-circuited. The same should the TX# and RX# (Pin 4 to 5). The short-circuit can be made with a jumper in the double row WAGO connector. Further details can be found in Figure 3.

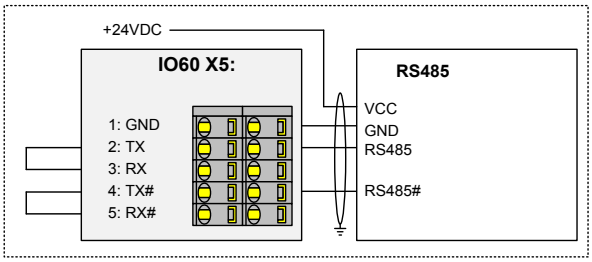


Figure 3: RS485 connection

11.3 Incremental encoder

Encoder connection examples can be seen in Figure 4 and Figure 5.

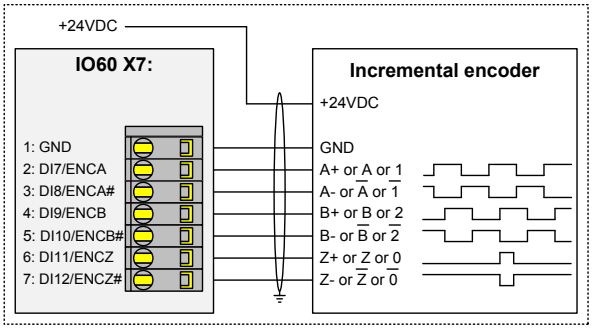


Figure 4: Differential input

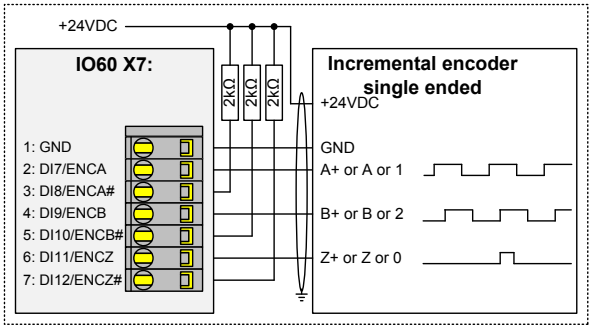


Figure 5: Single ended input

A 2kΩ resistor must be mounted in the connector according to Figure 4 for single ended configuration. For simpler wiring one 680Ω resistor can be used instead of 3 pcs 2kΩ. Note the power in the resistor will be 0.25W.

11.4 Digital outputs

Loads can be directly connected to the IO60 or via relays or contactors. The IO60 have integrated protection diodes, however it is recommended to place free wheel diodes close to inductive loads this will lead to a lower noise level in the system.
Further details can be found Figure 6.

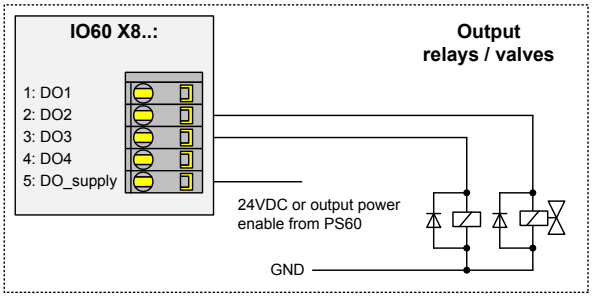


Figure 6: Digital output

Current capacity of the IO60 outputs must be observed.

11.5 Analog input

Active and passive current sensors can be connected to the IO60.
Further details can be found in Figure 7.

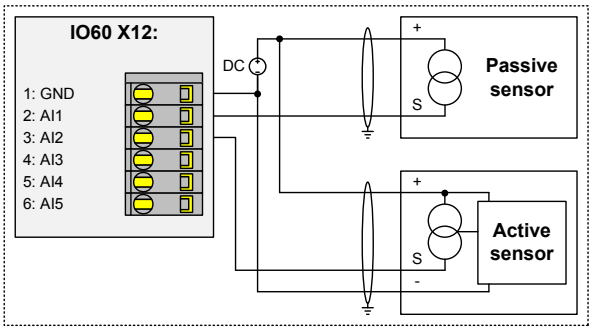


Figure 7: Analog input

11.6 Analog output

Sensors with analog current input can be connected to the IO60.
Further details can be found in Figure 8.

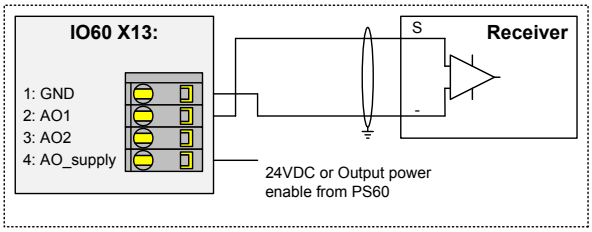


Figure 8: Analog output

11.7 CAN bus

Wiring examples of the CAN bus can be found in Figure 9 and Figure 10.

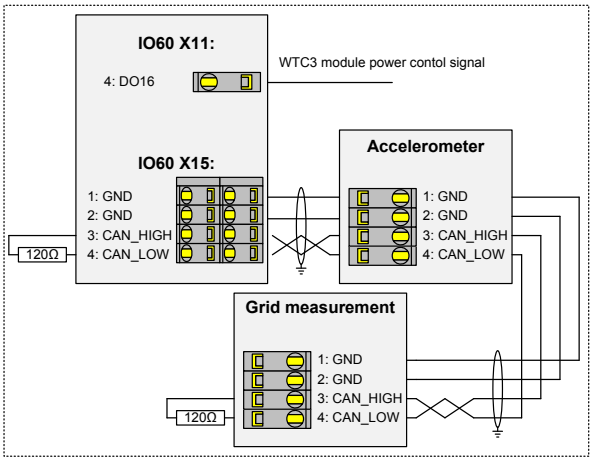


Figure 9: CAN connection to WTC3 modules

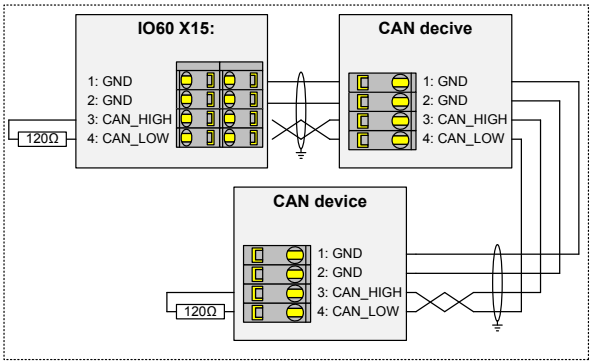


Figure 10: CAN connection to other modules

If both WTC3 modules and other CAN devices are required, additional IO60 module must be added. One module cannot be used for both types.

11.8 Temperature inputs

The IO60 supports both 2 wire and 3 wire PT-100 sensor solutions.
Further details can be found Figure 11 and Figure 12.

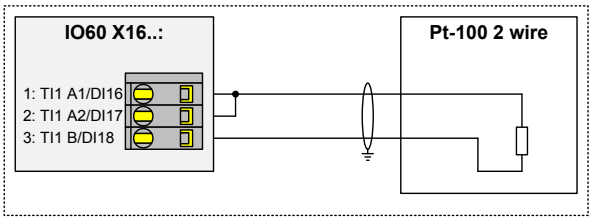


Figure 11: Temperature input 2-wire (PT-100)

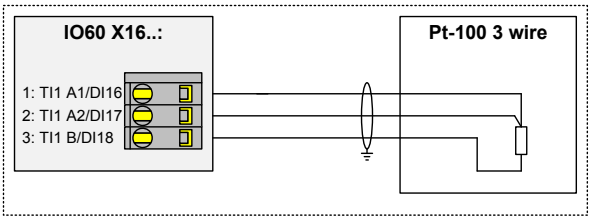


Figure 12: Temperature input 3-wire (PT-100)

Note that 2-wire PT-100 sensors are not cable compensated and therefore not recommended for long cables.

11.9 Power up of IO-60

The IO-60 power can be controlled from controller with a dedicated output direct on the controller, like PS60/CM60, CM60MK2 etc. This is described in section 11.9.1
If the controller/PLC does not have dedicated outputs for power control see section 11.9.2 (cases like Bachmann, Beckhoff or other PLC suppliers)

11.9.1 Controller with dedicated output

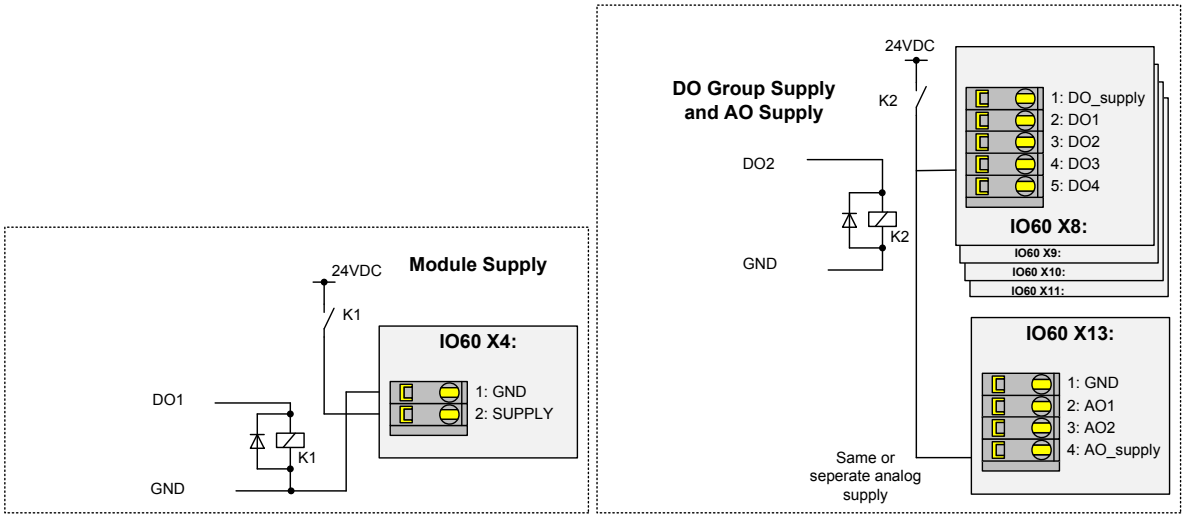


Figure 13 Power of IO-60 from controller with dedicated output

Preferred setup: see figure 13.

- First the controller power up the IO-60: Module Supply (X4).
- The controller check that the communication is up and running.
- Then the controller power up the IO-60 outputs: DO group supply and AO Supply (X8, X9, X10, X11 and X13).

Alternative setups:

- The IO-60 DO group supply and AO Supply use the same power as IO-60 Module Supply (X8, X9, X10, X11 and X13)
- Or directly to +24VDC. (X8, X9, X10, X11 and X13 direct power from +24V).

11.9.2 Controller without dedicated output

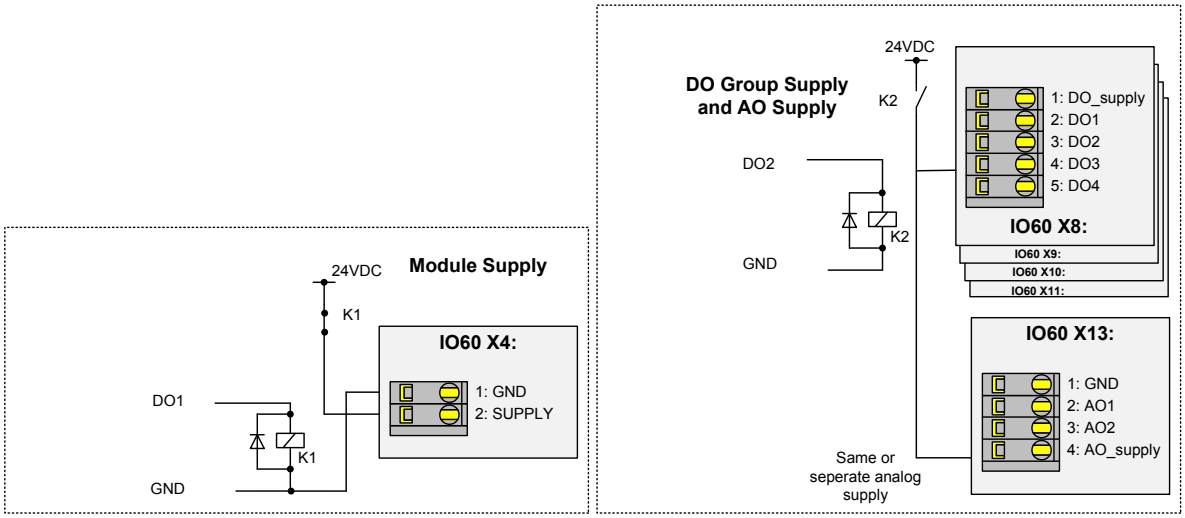


Figure 14 Power of IO-60 from controller without dedicated output

Preferred setup: see figure 14.

- Note: K1 is normally on!
- When the communication is up and running the controller power up the IO-60 DO Group supply and AO Supply.
- K1 can be used as reset off the IO-60.

Alternative setups:

- The IO-60 DO group supply and AO Supply use the same power as IO-60 Module Supply (X8, X9, X10, X11 and X13)
- Or directly to +24VDC. (X8, X9, X10, X11 and X13 direct power from +24V).

WTC3 CAN modules in this setup:

- If the controller also need a WTC3 CAN module please use the following set-up
- As normal DO16 is used as power for WTC3 CAN devices.
- K1 must then control both Module Supply and X11 DO Group Supply.