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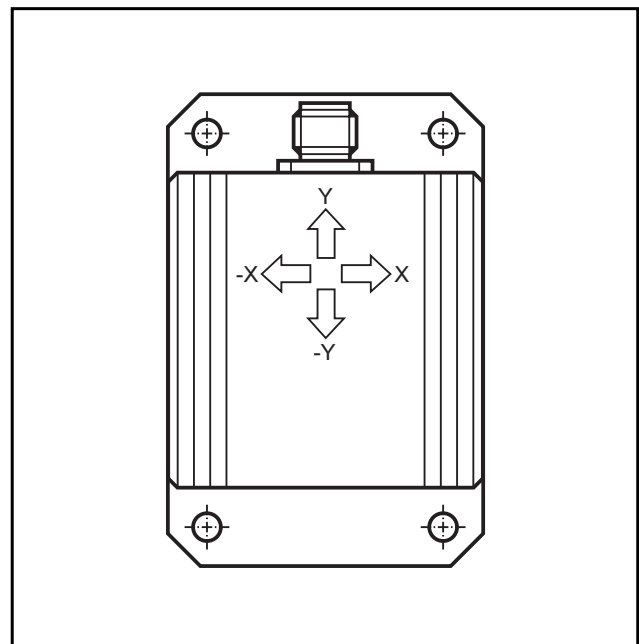


Geräte-Handbuch
Device manual

ecomat 1000[®]

Neigungssensor
2-achsig
Inclination sensor
2 axes

CR2101



Sachnr. 7390255/01 03/2006

ENGLISH

Safety instructions



This description is part of the unit. It contains texts and drawings concerning the correct handling of the controller and must be read before installation or use.

Observe the information of the description. Non-observance of the notes, operation which is not in accordance with use as prescribed below, wrong installation or handling can result in serious harm concerning the safety of people and plant.

The device may only be installed, connected and commissioned by qualified personnel.

Disconnect the device externally before doing any work on it. If necessary, also disconnect separately supplied output load circuits.

In the case of malfunctions or uncertainties please contact the manufacturer. Tampering with the device can lead to considerable risks for the safety of people and plant. It is not permitted and leads to an exclusion of any liability and warranty claims.

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Function and features

The 2-axis inclination sensor enables zero point levelling and position detection of mobile machines. Typical applications are for example the position detection of access platforms, levelling of mobile cranes and mobile machines.

Operating principle:

Two measuring cells which operate to the conductometric principle evaluate the change in conductivity of a liquid.

By applying an alternating voltage between the electrodes a current flows through the liquid and generates an electric field.

When the sensor is inclined the electric field changes and thus the conductivity of the liquid depending on the level. Arranging the electrodes in pairs results in a signed angle of inclination.

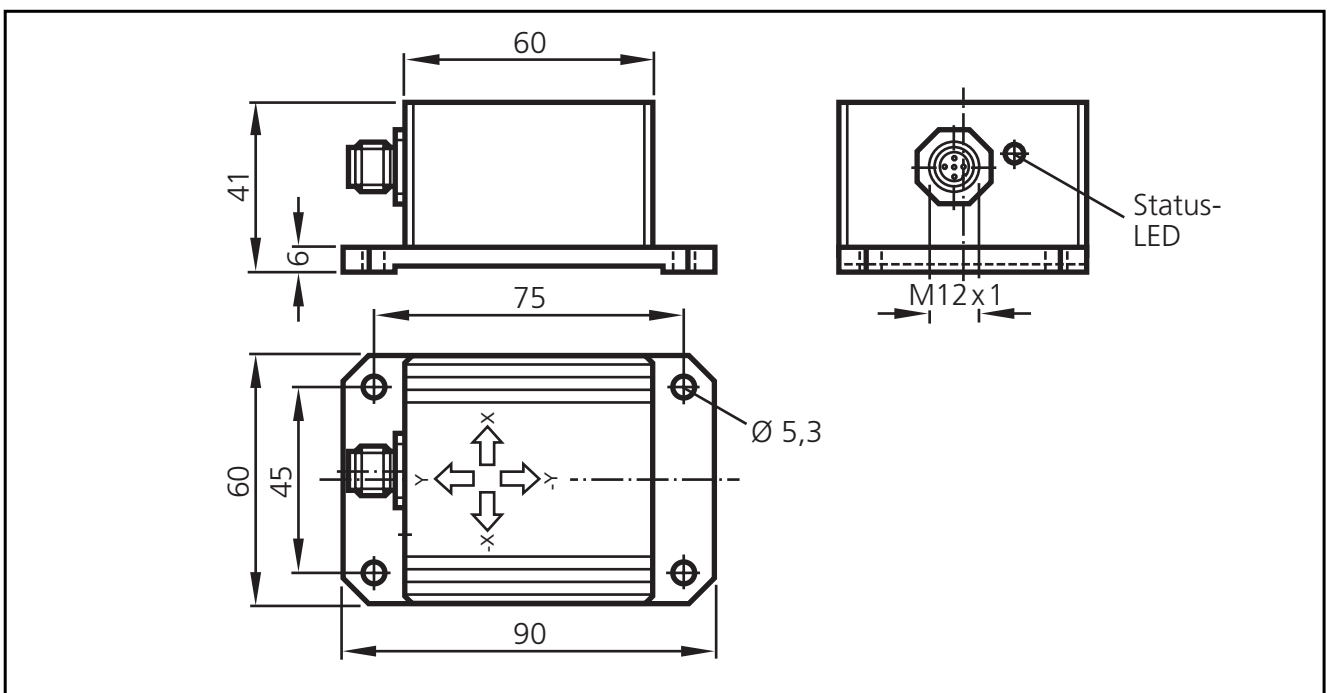
- Parameter setting of the sensor resolution and the 2-axis zero point is possible.
- 1 server SDO and 2 Transmit PDOs conforming to CiA DS 401 are available. The PDO mapping cannot be changed (static PDO mapping). Default identifiers have been assigned according to the "predefined connection set".
- The COB IDs of the PDOs as well as the type of transmission (synch/asynch) of the individual PDOs can be configured.
The type of transmission is stored non volatily. Changed PDOs (PDO linking) are stored volatily.
- The inclination sensor expects a synch object. The CAN identifier of the synch object can be configured. After a change the ID is automatically stored non volatily.
- The inclination sensor supports "node guarding".
The "guard time", the lifetime factor" and the CAN identifier of the guard object can be configured and are stored non volatily.
- The inclination sensor generates an emergency object. The COB ID of the EMCY object can be configured.
- The inclination sensor stores the last 4 errors occurred. The error code of the respective emergency object is stored.
- The inclination sensor supports a reset function, i.e. upon request the parameters are assigned to the factory default values*.

*) For the factory default setting see the "parameter list", page 26.

Technical Data

Housing	aluminium, black anodised
Mounting plate	aluminium, natural-coloured
Mounting	by means of 4 x M5 screws
Protection	IP 67
Connection	M12 plug for operating voltage and CAN bus 5 pins (type Lumberg)
Operating voltage	10 ... 30 V DC
Current consumption	≤ 100 mA
Operating temperature	-25 ... +85°C
Storage temperature	-25 ... +85°C
Measuring range (per axis)	±15°
Resolution	parameter setting up to 0.001°
Hysteresis	0.01°
Accuracy	0.025°
Temperature stability	
Zero drift	< 0.0013°/K
Sensitivity	< 0.006°/K
Interface	CAN interface 2.0 B, ISO 11898
Baud rate	10 kBit/s ... 1 MBit/s (125 kBit/s default)
Communication profile	CANopen, CiA DS 301 version 3.0
Node ID (default)	0x20 (= 32)
Status LED	two-colour LED (red/green)

Dimensions



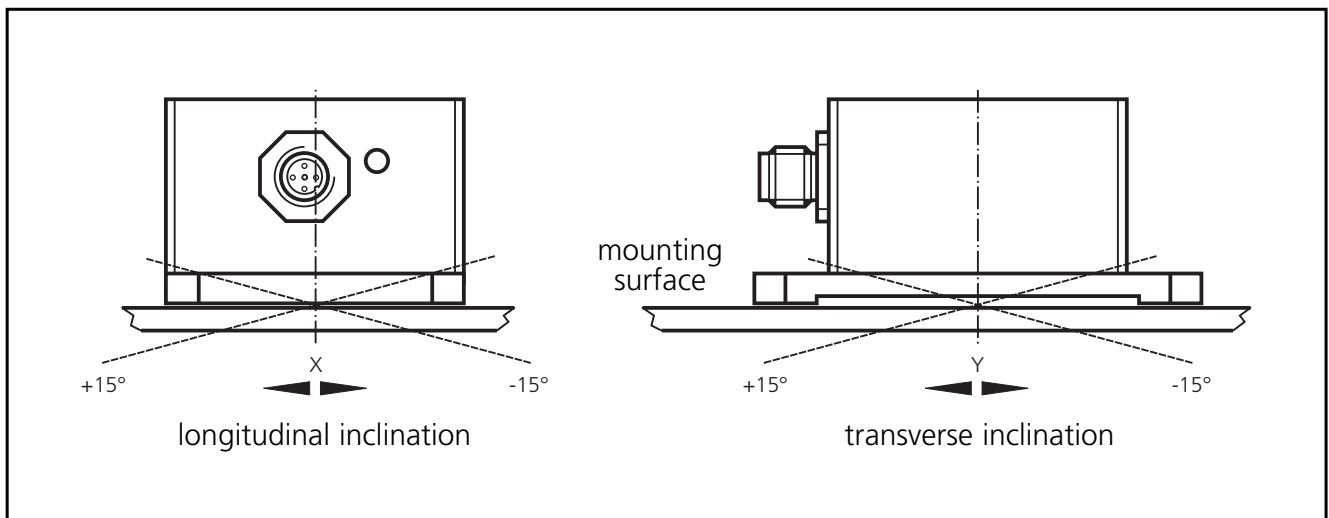
Mounting

The inclination sensor is fastened to the mounting fixture by means of 4 M5xL screws (conforming to DIN 7500 or DIN 7984) for levelling and detection. To obtain precise measured values avoid mounting onto fixtures which vibrate much and ensure a sufficient vibration decoupling if this is necessary.

When mounting ensure correct alignment of the inclination axes (see housing imprint).

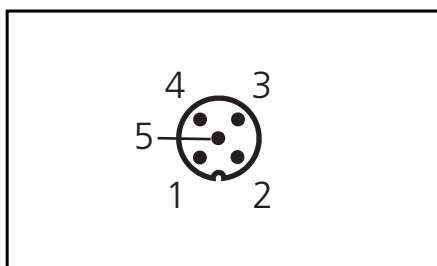
Longitudinal inclination = X axis (Trans PDO 1)

Transverse inclination = Y axis (Trans PDO 2)



The indicated signs of the angle of inclination correspond to the factory default setting.

Electrical connection



Designation	Pin	Potential
Operating voltage	1	GND
	2	10...30 V DC
CAN interface	3	CAN_GND
	4	CAN_H
	5	CAN_L

Before commissioning the pins indicated above must be connected to the respective potentials.



To protect the whole system (wiring and sensor) the supply voltage must be protected with max. 8 A.



To guarantee the electrical interference protection of the controller, the housing must be connected to GND (e.g. to the ground of the vehicle). In addition, the connection cable must be screened.

Parameter and EMCY object overview

With the function "restore" (see object directory, index 1011) the parameters (except the Baudrate and the node ID) can be assigned to the factory default values. With the next power on they become valid.

Parameterliste

Parameter	Index in object directory	default value (factory preset)	Change automatically saved	Change effective
Manufacturer Specific Profile Area; index 2000 to 5FFF				
Resolution	2000	0x01 (0.001°)	yes	after Pre-Op
Slope Long Sign PDO 1	2011	0x00 (see also housing imprint)	yes	immediately
Slope Long Offset	2013	0x00	yes	immediately
Slope Cross Sign PDO 2	2021	0x00 (see also housing imprint)	yes	immediately
Slope Cross Offset	2023	0x00	yes	immediately
Node ID	20F0, 20F1	0x20 (= 32)	yes	after a reset
Baud rate	20F2, 20F3	0x03 (= 125 Kbits/s)	yes	after a reset
Communication Profile Area; index 1000 to 1FFF				
COB ID Synch Objekt	1005	0x80	yes	immediately
Communication Cycle	1006	0x00 (Off)	yes	after Pre-Op
Guard Time	100C	0x00 (Off)	yes	immediately
Lifetime Factor	100D	0x00	yes	immediately
COB ID Guarding	100E	0x700 + Node ID	yes	immediately
COB ID EMCY	1014	0x80 + Node ID	yes	immediately
COB ID Trans PDO 1	1800 01	0x180 + Node ID	no	immediately
Trans Type Trans PDO 1	1800 02	synchronous 1	yes	immediately
COB ID Trans PDO 2	1801 01	0x280 + Node ID	no	immediately
Trans Type Trans PDO 2	1801 02	synchronous 1	yes	immediately

The lifetime factor 0 is interpreted as 1.

The first guard protocol is assessed as "start guarding" even if guarding is not active at this time (guard time = 0).

EMCY object

The following error codes are supported according to DS-301:

EMCY Code	Error Reg	Additional code	Description
0x6100	0x11	0x00	„Internal software“: - Overflow of a Rx queue, e.g. frequency of the Rx PDOs too high, only external reset via an entry in 1003 00
0x6101	0x11	0x00	„Internal software“: - Overflow of a Tx queue; e.g. device does not communicate with the bus, only external reset via an entry in 1003 00
0x6300	0x81	0b0000xxxx	inclination sensor above or below range 0001 long (X) above range 0010 long (X) above range 0100 cross (Y) above range 1000 cross (Y) above range Caution! The transmitted inclination value is not valid if it is above or below range.
0x8100	0x11	0x00	„Monitoring“ (guarding error) - For the "guard time" x "lifetime factor" no guard object is received Reset after node is active again
0x8200	0x11	0x00	„Monitoring“ (synch error) - For "communication cycle" no synch object is received. Only in OPERATIONAL Reset with the next synch OBJ or PREOP

The CANopen status does not change in the case of guard error and/or synch error.

Operating indication (status LED)

LED green	OFF	No supply voltage
	ON	Sensor in the stand by mode CANopen status: PREOPERATIONAL / PREPARED Angle values are not transmitted
	flashing 2 Hz	Module active CANopen status: OPERATIONAL Angle values are transmitted
LED red	OFF	Communication ok
	ON	Communication disturbed Angle values are not transmitted - NodeGuard error (if NodeGuarding is active) - No synch objects (if synch monitoring is active)

Object directory

Manufacturer specific profile area, index 2000 to 5FFF

Index	S-idx	Name	Type	Default	Description
2000	0	resolution	u16, rw	0x01	Measured value resolution of the two axes 1 = inclination is indicated as signed int in 0.001 degree 10 = inclination is indicated as signed int in 0.01 degree 100 = inclination is indicated as signed int in 0.1 degree 1000 = inclination is indicated as signed int in 1.0 degree
2010	0	slope long	s16, ro	-	Inclination of the longitudinal axis (X axis)
2011	0	slope long sign	boolean rw	0x00	Sign of the inclination of the longitudinal axis; 0 = as specified by the manufacturer (see housing imprint) 1 = inverted
2012	0	slope long zero	ZERO wo	-	Access to this entry sets the application zero point of the longitudinal axis. The current inclination of the longitudinal axis is processed as application offset.
2013	0	slope long offset	s16, rw	0x00	Includes the current application offset of the longitudinal axis. The application offset can be set or read after "slope long zero".
2020	0	slope cross	s16, ro	-	Inclination of the transverse axis (Y axis)
2021	0	slope cross sign	boolean rw	0x00	Sign of the inclination of the transverse axis; 0 = as specified by the manufacturer (see housing imprint) 1 = inverted
2022	0	slope cross zero	ZERO wo	-	Access to this entry sets the application zero point of the transverse axis. The current inclination of the longitudinal axis is processed as application offset.
2023	0	slope cross offset	s16, rw	0x00	Includes the current application offset of the transverse axis. The application offset can be set or read after "slope cross zero".

Object directory

Manufacturer specific profile area, index 2000 to 5FFF

Index	S-idx	Name	Type	Default	Description
20F0	0x00	Setting of the Node ID	u8, rw	0x20 (= 32)	The node ID used to access the sensor in the CANopen network
20F1	0x00	Setting of the Node ID	u8, rw	0x20 (= 32)	The node ID used to access the sensor in the CANopen network
<p>A change of the Node ID is only accepted if the entries 20F0 and 20F1 contain the same changed value. Values below 1 / above 127 are not accepted; the existing setting remains valid. After setting the new entries a reset must be made so that the new entries become valid (switch off the module for a short time).</p>					
20F2	0x00	Setting of the Baud rate	u8, rw	0x03	Baud rate of the CAN network 0 = 1000 kBaud 1 = 500 kBaud 2 = 250 kBaud 3 = 125 kBaud 4 = 100 kBaud 5 = 50 kBaud 6 = 20 kBaud 7 = 10 kBaud
20F3	0x00	Setting of the Baud rate	u8, rw	0x03	Baud rate of the CAN network (see above)
<p>A change of the Baud rate is only accepted if the entries 20F2 and 20F3 contain the same changed value. Values above 7 are not accepted; the existing setting remains valid. After setting the new entries a reset must be made so that the new entries become valid (switch off the module for a short time).</p>					

Explanation of the abbreviations:

0x... = hexadecimal number
 rw = read-write
 ro = read only
 s16 = signed 16 bit
 u8 = unsigned 8 bit
 u16 = unsigned 16 bit
 wo = write only

(see also „Terms and abbreviations“, page 40)

Object directory

Communication Profile Area; index 1000 to 1FFF

Index	S-idx	Name	Type	Default	Description
1000	0	device type	u32, ro	0x80191	Profile 401; analog outputs
1001	0	error register	u8, ro	0x00	Bit-coded to profile 301; the following is supported: 0b 0000 0000 no error 0b 0000 0001 generic error 0b 0001 0000 communication error 0b 1000 0000 manufacturer specific
1003	0	pre-defined errorfield	u8, ro	0x02	An error list with 4 entries is supported.
	1 - 4	error history	u32, ro	0x00	Error occured, coded according to the EMCY list, the last error is in the sub-index 1
1004	0	number of PDOs	u32, ro	0x00002	2 Trans PDOs are supported
	1	number of synch PDOs	u32, ro	0x00002	The PDOs can be transmitted synchronously
	2	number of asynch PDOs	u32, ro	0x00002	The PDOs can be transmitted asynchronously
1005	0	COB ID synch objekt	u32, rw	0x80000080	- Sensor expects synch message (bit 31 = 1) - Sensor generates no synch message (bit 30 = 0) - 11-bit identifier system (bit 29 = 0) - Identifier of the synch message
1006	0	Communic. Cycle	u32, rw	0x00000000	Max. time between 2 synch objects in μ s; useful resolution = 1ms
1007	0	synch windows	-	-	Not implemented
1008	0	device name	str, ro	CR2101	Device designation
1009	0	HW Version	str, ro	x.x	Hardware version
100A	0	SW Version	str, ro	x.x	Software version
100B	0	Node ID	u32, ro		Only for information
100C	0	guard time	u16, rw	0x0000	Time in ms Within this time the sensor expects a "node guarding" of the network master. If the value 0 is entered here, this function is not supported.

Object directory

Communication Profile Area; index 1000 to 1FFF

Index	S-idx	Name	Type	Default	Description
100D	0	lifetime factor	u8, rw	0x00	If no „node guarding“ is received for „guard time“ x „lifetime“, the sensor generates an EMCY. The result from „guard time“ x „lifetime“ must be between 0 and 65535.
100E	0	COB ID guarding	u32, rw	0x00000700 +Node ID	CAN identifier of the node guard object
1010	0	number of save-options	u8, ro	0x01	Number of the „save“ options
	1	"save all parameters"	u32, rw	0x02	All parameters are automatically saved after a change.
1011	0	number of restore-options	u8, ro	0x01	Number of the „restore“ options
	1	"reset for all parameters"	u32, rw	0x01	If the string „load“ is entered here, the parameters are assigned to the factory default values and are valid after the next reset.
1014	0	COB ID Emergency	u32, rw	0x40000080 +Node ID	<ul style="list-style-type: none"> - Sensor does not react to external EMCY message (bit 31 = 1) - Sensor generates EMCY message (bit 30 = 1) - 11-bit ID (Bit 29 = 0) - ID = 0x80 + Node ID CAN identifier can be changed by the user.
1200	0	Server SDOs	u8, ro	0x02	Number of the entries
	1	COB ID Rec SDO	u32, ro	0x600 + Node ID	<ul style="list-style-type: none"> - SDO is valid (bit 31 = 0) - CAN ID of the receive SDO
	2	COB ID Trans SDO	u32, ro	0x580 + Node ID	<ul style="list-style-type: none"> - SDO is valid (bit 31 = 0) - CAN ID of the transmit SDO

Object directory

Communication Profile Area; index 1000 to 1FFF

Index	S-idx	Name	Type	Default	Description
1800	0	Trans PDO 1	u8, ro	0x02	Number of the entries Trans PDO 1 Inclination of the longitudinal axis (X axis)
	1	COB ID	u32, rw	0x180 + Node ID	- PDO is valid (bit 31 = 0) - CAN ID of the 1st Trans PDO
	2	Trans Type	u8, rw	0x01	0x00 = synch acyclic 0x01...0xF0 = synch cyclic Outputs are only updated after "n" synch objects. n = 0x01 (1) ... 0xF0 (240) 0xFC not implemented 0xFD not implemented 0xFE = asynch man. spec. event PDO is immediately transmitted in the case of a change of the inclination by the smallest unit set (see resolution). 0xFF = asynch device profile event PDO is immediately transmitted in the case of a change of the inclination by the smallest unit set (see resolution).
1801	0	Trans PDO 2	u8, ro	0x02	Number of the entries Trans PDO 2 Inclination of the transverse axis (Y axis)
	1	COB ID	u32, rw	0x280 + Node ID	- PDO is valid (bit 31 = 0) - CAN ID of the 2nd Trans PDO
	2	Trans Type	u8, rw	0x01	0x00 = synch acyclic 0x01...0xF0 = synch cyclic Outputs are only updated after "n" synch objects. n = 0x01 (1) ... 0xF0 (240) 0xFC not implemented 0xFD not implemented 0xFE = asynch man. spec. event PDO is immediately transmitted in the case of a change of the inclination by the smallest unit set (see resolution). 0xFF = asynch device profile event PDO is immediately transmitted in the case of a change of the inclination by the smallest unit set (see resolution).
1A00	0	Mapping Trans PDO 1	u8, ro	0x01	Number of the application objects integrated into the Trans PDO 1
	1	Index in the object directory	u32, rw	0x2010 00	The inclination of the longitudinal axis is indicated in the Idx 2010 00.
1A01	0	Mapping Trans PDO 2	u8, ro	0x01	Number of the application objects integrated into the Trans PDO 2
	1	Index in the object directory	u32, rw	0x2020 00	The inclination of the transverse axis is indicated in the Idx 2020 00.

Maintenance, repair and disposal

As the inclination sensor does not contain any components which must be maintained by the user, the housing must not be opened.

The sensor may only be repaired by the manufacturer.

The disposal must be carried out according to the corresponding national environmental regulations.

Declaration of conformity

The CE marking is applied on the basis of the EMC directive EMC 89/336/EEC, implemented in the standards EN 500 81-1 and EN 500 82-2 as well as the low voltage directive NS73/23/EEC, implemented in the standard EN 61010.

Test standards and regulations

- Immunity to conducted interference
 - to ISO 7637-2: 2004, pulses 2a, 3a, 3b, 4, severity level 4, function state A
 - to ISO 7637-2: 2004, pulse 1, 2b, severity level 4, function state C
 - to ISO 7637-2: 2004, pulse 5, severity level 1, function state A
- Immunity to interfering fields
 - to directive 2005/49/EC at 30 V/m (e1 type approval)
 - and EN 500 82-2 (CE)
- Interference emission
 - to directive 2005/49/EC (e1 type approval)
 - and EN 500 81-1 (CE)

Programming (ecolog 100^{plus})

General

The inclination sensor must be initialised as CANopen slave with the CANopen start functions "COP_MSTR_BOOTUP" and "COP_MSTR_MAIN" by the R360 master and set to the state "OPERATIONAL" (LED flashes green, 2 Hz).

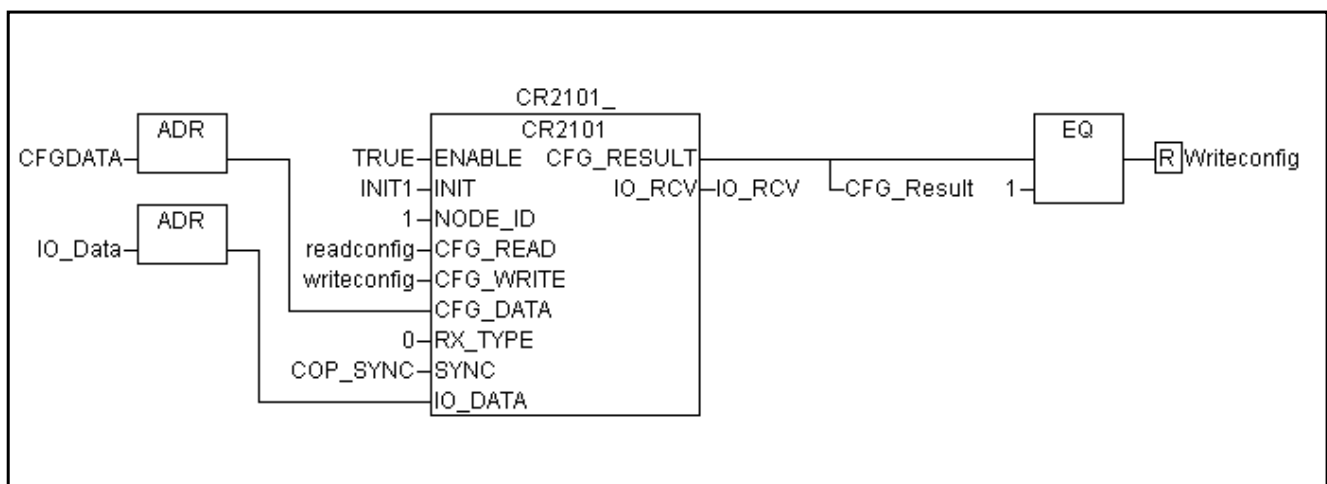
Programming function

If the function "CR2101" is integrated into the program, this automatically ensures a continuous updating of the X/Y measured data in the controller. The function "CR2101" is in the library "CR2101.lib" of the ifm programming software ecolog 100^{plus}.

If no configuration data are transferred to the inclination sensor, the device operates with the default values set at the factory.

Before commissioning change the node ID of the inclination sensor set at the factory, if necessary. Check whether the baud rate of the master and that of the sensor are identical or set accordingly.

Default values: node ID = 0x20 (= 32)
 baud rate = 0x03 (= 125 Kbits/s)

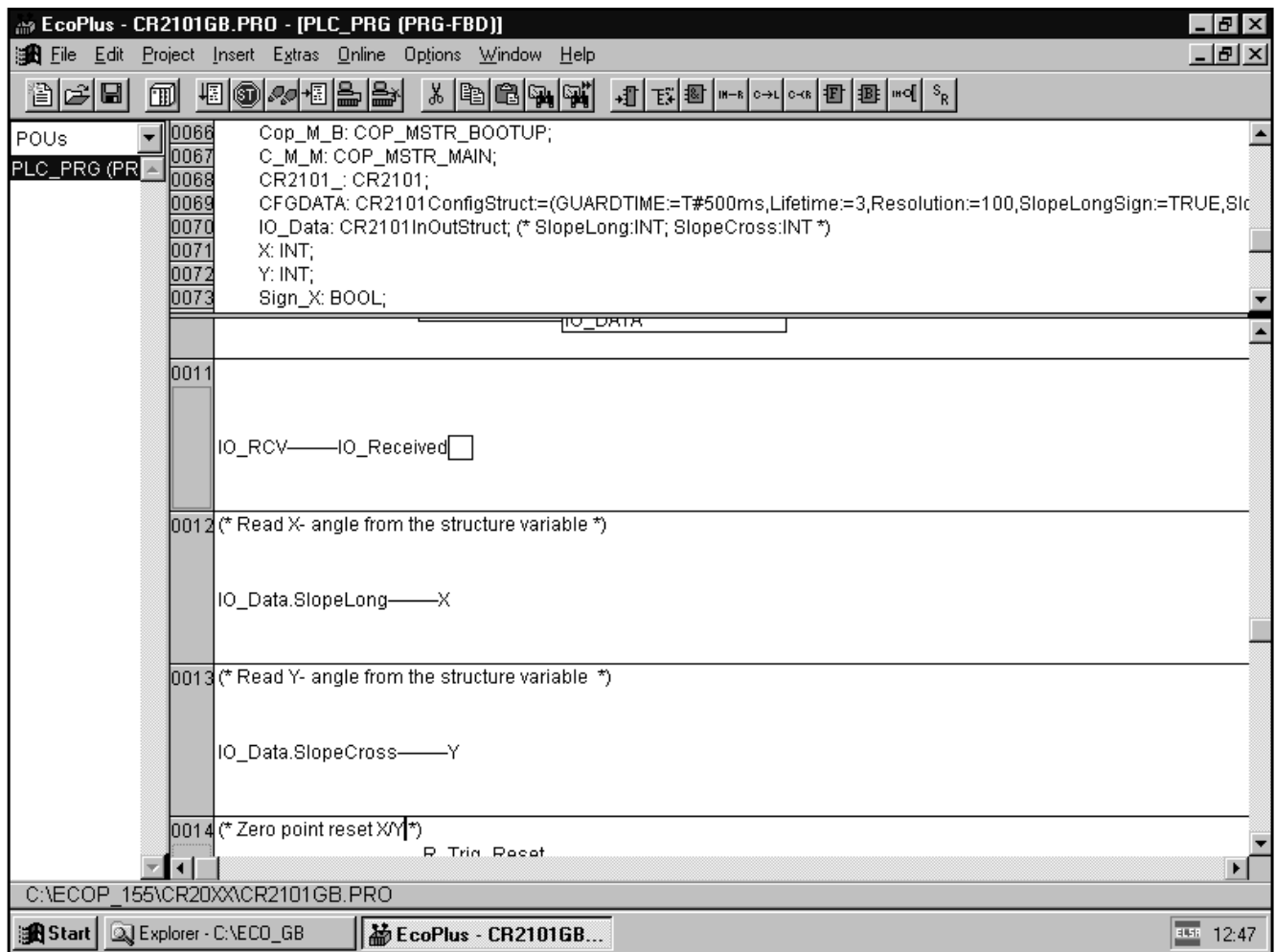


Screen shot detail of the ecolog 100^{plus} programming platform

Data structures

The CR2101 configuration and measured data are transferred via data structures. The structure as well as other variable types must be declared in the declaration part. For configuration data the declaration part can already contain an assignment of values.

In the program access to a structure component can be represented as follows:



Screen shot of the ecolog 100^{plus} programming platform

More ecolog 100^{plus} programming examples of the inclination sensor CR2101 can be obtained from ifm electronic gmbh upon request.

- **Function:** CR2101
- **Library:** CR2101.lib
- **Purpose:** Sets parameters and reads the configuration and measured values of the 2-axis inclination sensor CR2101

CR2101	
ENABLE	CFG_RESULT
INIT	IO_RCV
NODE_ID	
CFG_READ	
CFG_WRITE	
CFG_DATA	
RX_TYPE	
SYNC	
IO_DATA	

■ Parameter

Name	Data type	Description
Inputs		
ENABLE	BOOL	TRUE: function processing
INIT	BOOL	TRUE: function initialisation FALSE: cyclical function call
NODE_ID	BYTE	Node identifier
CFG_READ	BOOL	TRUE: read the current configuration of the inclination sensor
CFG_WRITE	BOOL	TRUE: write the current configuration of the inclination sensor
CFG_DATA	DWORD	Address of the configuration data (data structure)
RX_TYPE	BYTE	Receive transmission type (default = 0)
SYNC	BOOL	CANopen synchronisation cycle (system variable COB_SYNC)
IO_DATA	DWORD	Address of the input/output data (data structure)
Outputs		
CFG_RESULT	BYTE	1 = configuration read or written successfully 2 = configuration not yet read or written 3 = configuration cannot be read or written (missing or incorrect node ID or faulty device)
IO_RCV	BOOL	True: for one cycle if new data were transmitted

If not described otherwise, a "FALSE" signal with boolean data types is always the negation of the described "TRUE" signal.

■ **Data structure:
CR2101 ConfigStruct**

■ Purpose:
Parameter and configuration data can be written or read.
The data structure is assigned to the function input "CFG_DATA" via the ADR operator.

```

TYPE CR2101 ConfigStruct
STRUCT
  GUARDTIME: TIME;
  LIFETIME: BYTE;
  Resolution: WORD;
  SlopeLongSign: BOOL;
  SlopeLongSetZero: BOOL;
  SlopeLongOffset: INT;
  SlopeLongOffsetWriteEnable: BOOL
  SlopeCrossSign: BOOL;
  SlopeCrossSetZero: BOOL;
  SlopeCrossOffset: INT;
  SlopeCrossOffsetWriteEnable: BOOL
END_STRUCT
END_TYPE
    
```

■ Structure components

Name	Data type	Description
GUARDTIME	TIME	Guarding time of the inclination sensor (ms)
LIFETIME	BYTE	Guarding time of the inclination sensor (ms)
Resolution	WORD	Measured value resolution of the two axes 1 = 0.001° (signed int) 10 = 0.01° (signed int) 100 = 0.1° (signed int) 1000 = 1.0° (signed int) To change the resolution the sensor is first set to the state "preoperational" and then back to the state "operational". At the same time the input "CFG_WRITE" must be set to TRUE.
Longitudinal axis (X)		
SlopeLong Sign	BOOL	Sign of the inclination of the longitudinal axis (X) FALSE (0) = as specified by the manufacturer on the housing imprint TRUE (1) = inverted
SlopeLong SetZero	BOOL	Sets the application zero point of the longitudinal axis (X), i.e. the current inclination of the longitudinal axis is processed as application offset. To do so, this variable and the input "CFG_WRITE" must be set to TRUE until the value of the output "CFG_RESULT" is again "1".
SlopeLong Offset	INT	Includes the current application offset of the longitudinal axis (X). The application offset can be set or read. To do so, the input "CFG_WRITE" or CFG_READ" is set to TRUE. After a power failure the value is not lost.
SlopeLong OffsetWrite Enable	BOOL	SlopeLongOffset is set again to "0" with the variable TRUE. At the same time the input "CFG_WRITE" must be set to TRUE until the value of the output "CFG_RESULT" is again "1".
Transverse axis (Y) see the following page		

■ Structure components (to be continued)

Name	Data type	Description
Transverse axis (Y)		
SlopeCross Sign	BOOL	Sign of the inclination of the transverse axis (Y) FALSE (0) = as specified by the manufacturer on the housing imprint TRUE (1) = inverted
SlopeCross SetZero	BOOL	Sets the application zero point of the transverse axis (Y), i.e. the current inclination of the transverse axis is processed as application offset. To do so, this variable and the input "CFG_WRITE" must be set to TRUE until the value of the output "CFG_RESULT" is again "1".
SlopeCross Offset	INT	Includes the current application offset of the transverse axis (Y). The application offset can be set or read. To do so, the input "CFG_WRITE" or "CFG_READ" is set to TRUE. After a power failure the value is not lost.
SlopeCross OffsetWrite Enable	BOOL	SlopeCrossOffset is set again to "0" with the variable TRUE. At the same time the input "CFG_WRITE" must be set to TRUE until the value of the output "CFG_RESULT" is again "1".

■ **Data structure:**
CR2101 InOutStruct

■ Purpose:
The current angle data of the two axes are read.
The data structure is assigned to the function input "IO_DATA" via the ADR operator.

```

TYPE CR2101 InOutStruct
STRUCT
    SlopeLong: INT;
    SlopeCross: INT;
END_STRUCT
END_TYPE
    
```

■ Structure components

Name	Data type	Description
SlopeLong	INT	Current inclination angle of the longitudinal axis (X)
SlopeCross	INT	Current inclination angle of the transverse axis (Y)

Terms and abbreviations

0b ...	binary value (for bit coding), e.g. 0b0001 0000
0x ...	hexadecimal value, e.g. 0x64 (= 100 decimal)
Baudrate	transmission speed (1 baud = 1 bit/s)
CAL	CAN Application Layer CAN-based network protocol on application level
CAN	Controller Area Network (bus system for use in mobile applications)
CAN_H	CAN-High; CAN connection /cable with high voltage level
CAN_L	CAN-Low; CAN connection /cable with low voltage level
CANopen	CAN-based network protocol on application level with an open configuration interface (object directory)
CiA	"CAN in Automation e.V." (user and manufacturer organisation in Germany /Erlangen) Definition and control body for CAN and CAN-based network protocols
CiA DS	Draft Standard (published CiA specification which usually has not been modified or supplemented for one year)
CiA DSP	Draft Standard Proposal (published CiA specification draft)
CiA WD	Work Draft (work draft accepted for discussion within CiA)
CiA DS 301	Specification for CANopen communication profile; describes the basic communication between network participants, such as the transfer of process data in real time, the exchange of data between units or the configuration stage. Depending on the application this is completed by the following CiA specifications:
CiA DS 401	Device profile for digital and analog I/O modules
CiA DS 402	Device profile for drives
CiA DS 403	Device profile for HMI
CiA DS 404	Device profile for measurement and control technology
CiA DS 405	Specification for interfaces to programmable systems (IEC 1131)
CiA DS 406	Device profile for encoders
CiA DS 407	Application profile for local public transport
COB	CANopen Communication Object (PDO, SDO EMCY, ...)
COB ID	CANopen Identifier of a Communication Object
Communication cycle	the synchronisation time to be monitored, max. time between 2 Sync objects
EMCY Object	Emergency Object (alarm message, device indicates an error)
Error Reg	Error Register (entry with an error code)
Guarding Error	Node or network participant could or can no longer be found Guard Master: one or several slaves no longer reply Guard Slave: no polling of the slave
Guard Time	During this time the network participant expects a "Node Guarding" of the network master
Heartbeat	Cyclic monitoring with parameter setting among network participants. In contrast to "node guarding" no superior NMT master is required.
ID	Identifier; identifies a CAN message. The numerical value of the ID also contains a priority for the access to the bus system ID 0 = top priority
Identifier	see ID
Idx	index; together with the S index it forms the address of an entry in the object directory
Life Time Factor	number of attempts in case of a missing Guarding reply
Monitoring	is used to describe the error class (guarding monitoring, synch etc.)
NMT	network management
NMT master/slaves	The NMT master controls the operating states of the NMT slaves
Node Guarding	adjustable cyclic monitoring of slave network participants by a higher master node as well as the monitoring of this polling process by the slave participants

Node ID	node identifier (identification of a participant in the CANopen network)
Object (also OBJ)	term for data/messages which can be exchanged in the CANopen network
Object directory	contains all CANopen communication parameters of a device as well as device-specific parameters and data Access to the individual entries is possible via the index and S index.
Operational	Operating state of a CANopen participant In this mode SDOs, NMT commands and PDOs can be transferred.
PDO	Process Data Object; in the CANopen network for transfer of process data in real time; such as the speed of a motor PDOs have a higher priority than SDOs; in contrast to the SDOs they are transferred without confirmation. PDOs consist of a CAN message with identifier and up to 8 bytes of user data.
PDO Mapping	describes the application data transferred with a PDO.
Pre-Op	Preoperational; operating state of a CANopen participant. After application of the supply voltage each participant automatically goes into this state. In the CANopen network only SDOs and NMT commands can be transferred in this mode but no process data.
Prepared	(also stopped) operating state of a CANopen participant In this mode only NMT commands are transferred.
Rec PDO (also Rx PDO)	Receive Process Data Object
ro	read only (unidirectional)
rw	read-write (bidirectional)
RX-Queue	reception buffer
s16	data type signed 16 bit
SDO	Service Data Object; With this object direct access to the object directory of a network participant is possible (read/write). An SDO can consist of several CAN messages. The transfer of the individual messages is confirmed by the addressed participant. With the SDOs devices can be configured and parameters can be set.
Server SDO	process and parameter set to make the object directory of a network participant available to other participants (clients).
S-Idx (also SIdx)	Subindex within the object directory of a CANopen device
Start Guarding	start node guarding
str	data type string (variable for strings such as text "load")
Sync Error	missing Sync OBJ in the adjustable communication cycle
Sync object	synchronisation object for simultaneous update in the complete network or for accepting process data of the respective parameterised PDOs.
Sync Windows	time during which the synchronous PDOs have to be transferred
Time Stamp	time stamp to align existing clocks in network participants
Trans Type	type of process data transmission; synchronous, asynchronous
Trans PDO (also Tx PDO)	transmit process data object
Trans SDO (also Tx SDO)	transmit service data object
Tx Queue	(transmit) transmission buffer
u8 (16, 32)	data type unsigned 8 (16, 32) bits
wo	write only