CANopen Configuration

The CML 7xx light curtains communication is corresponding according the CANopen Profile „DS3101" and „DS401".
The communication profil area from index 1000h – 1FFFh contains the CANopen standard parameters.
Product specific parameters starts at index 2000h

Communication specific parameters are automatically persistent. To save product specific settings against power failure, it´s necessary to send save command (Index 0x2200)

CANopen-specific objects

Parameter	Index (Hex.)	Subindex (Hex.)	Data type		Access	Min.-Value	Max. Value	Default	Remark
Device Type	1000				RO			0x008B0191	
Error Register	1001				RO				
COB-ID-SYNC	1005				RW			0x00000080	
Receiver Product Name	1008				CONST				
Hardware Revision	1009				CONST				
Software Revision	100A				CONST				
Producer Heartbeat Time	1017				RW			0	Required for heartbeat meachanism
Identity Object	1018				RO				Contains general information regarding the device
PDO_COMMUNICATION_PARAMETER_1	1800				RW				Character of PDO 1
PDO_COMMUNICATION_PARAMETER_2	1801				RW				Character of PDO 2
PDO_COMMUNICATION_PARAMETER_3	1802				RW				Character of PDO 3
PDO_COMMUNICATION_PARAMETER_4	1803				RW				Character of PDO 4
PDO_MAPPING_PARAMETER_1	1A00		t32U		RW				Mapped objects of PDO 1
PDO_MAPPING_PARAMETER_2	1A01		t32U		RW				Mapped objects of PDO 1
PDO_MAPPING_PARAMETER_3	1A02		t32U		RW				Mapped objects of PDO 1
PDO_MAPPING_PARAMETER_4	1A03		t32U		RW				Mapped objects of PDO 1

Device Description

Parameter	Index (Hex.)	Subindex (Hex.)	Data type		Access	Min.- Value	Max. Value	Default	Remark
Vendor name	2000				RO				Leuze electronic
Vendor Text	2001				RO				The sensor people
Receiver Product ID	2002				RO				Receiver
Receiver Serial Number	2003				RO				Receiver
Transmitter Product Name	2008				RO				Transmitter
Transmitter Product ID	2009				RO				Transmitter
Transmitter Serial Number	200A				RO				Transmitter
Device characterisitcs specifiy the beam distance, the number of physical / logical beams, number of arrays (16 single beams) and the cycle time of the device.									
Beam Distance	200B	1	t16U		RO				
Number of physical beams	200B	2	t16U		RO				
Number of configured logical beams	200B	3	t16U		RO				If parallel beam scanning configured, number of logical beams are same as physical (optical) beams. In case of diagnol scanning, number of logical beams will be doubled.
Number of optical cascades	200B	4	t16U		RO				
Device cycle time [µs]	200B	5	t16U		RO				Period of one measuring /scanning loop. Min. 1ms

Global Settings

Global settings allows setting of beam functions (parallel-/diagonal-/cross-beam), counting direction and min. object size for analysis (smoothing).
Min. size of a hole in e.g. a web will be configured by inverted. smoothing.

Parameter	Index (Hex.)	Subindex (Hex.)	Data type		Access	Min.- Value	Max. Value	Default	Remark
Mode of operation	2100	1	t08U		RW	0	3	0	0: Parallel beam scanning 1: Diagonal beam scanning 2: Cross beam scanning
Counting direction	2100	2	t08U		RW	0	1	0	0: normal – starting at the connector side 1: Inverted – starting opposite the connector side
Smoothing	2100	3	t08U		RW	1	MAX_T08U	1	Less than N **interrupted** beams will be ignored
Inverted Smoothing	2100	4	t08U		RW	1	MAX_T08U	1	Less than N **not interrupted** beams will be ignored

Additional Settings

Measuring values are suppressed until the configured number of consistent scans is reached.
During latch time period all measurement values are accumulated and latched.

Parameter	Index (Hex.)	Subindex (Hex.)	Data type		Access	Min.- Value	Max. Value	Default	Remark
	2101	1	t08U		RW	0			reserved
Filter depth	2101	2	t08U		RW	0	MAX_T08U	1	Number of consistent scans until measuring result will be passed to the interface
Latch time (hold function)	2101	3	T16U		RW	0	MAX_T16U	0	Latch time in ms During latch time period all measurement values are accumulated and latched

Cascading Configuration

To avoid interferences multiple light curtains can be cascaded. The master generates the cyclic trigger signal, the slaves start their scanning after the configured delay time (different delay values required).

Parameter	Index (Hex.)	Subindex (Hex.)	Data type		Access	Min.-Value	Max. Value	Default	Remark
Cascading	2102	1	t08U		RW	0	1	0	0: inactiv (continuous scanning) 1: activ (sensor waiting for trigger-signal) Notice: In case of working in cascading application, it´s necessary to set master on 1 (activ)
Function mode	2102	2	t08U		RW	0	1	0	0: Slave (waiting for trigger signal) 1: Master (generating trigger signal)
Delay trigger → start scanning	2102	3	T16U		RW	500	MAX_T16U	500	Delay time in **µs** (starting at rising edge of trigger signal until start of measuring / scanning cycle)
Triggerpulse width	2102	4	T16U		RO			100	Puls width of master-trigger-puls in µs (Just for information)
Master Cycletime	2102	5	T16U		RW	1	6500	1	Period of a trigger loop in **ms**

Teach Settings

In most of applications it is generally recommended to store teach results power fail safe.
Corresponding to the selected function reserve at teach operation, the sensitivity will be higher or smaller.
Small function reserve = high sensitivity

Parameter	Index (Hex.)	Subindex (Hex.)	Data type		Access	Min.-Value	Max. Value	Default	Remark
Teach Count	2103	1	t08U		RO			10	Depending of environmental conditions resp. application conditions it can happen, that systems takes more than one teach loop after a teach command.
Teach Mode	2103	2	t08U		RW	0	1	0	0: Save persistent to Flash 1: Save transient to RAM
Responsivity after teach	2103	3	t08U		RW	0	2	0	0: High function reserve for robust application 1: Medium function reserve 2: Small function reserve
Teach Status	2400	1	t08S		RO	0	MAX_T08U		Feedback about last teach result: 0x00: Teach ok 0x01: Teach busy 0x80: Teach error (Bit8 = Errorbit)

Blanking Configuration

Up to 4 blanking areas can be configured.
Deactivated beams can be setted to 0, 1 or the logical value of the neighbour beam.
If autoblanking is activated, the number of choosen blanking areas will be configured with teach command.
Details see appendix B:

Parameter	Index (Hex.)	Subindex (Hex.)	Data type		Access	Min.- Value	Max. Value	Default	Remark
Number of autoblanking areas	2104	1	t08U		RW	0	4	0	Required number of blanking areas if using autom. teach
Autoblanking (during teach)	2104	2	t08U		RW	0	1	0	0: Inactiv (only manual configuration possible) 1: Activ (blanking areas autom. configured by teach)
Function blanking area 1	2104	3	t16U		RW	0	4	0	0: No beams blanked 1: Logical value 0 for blanked beams 2: Logical value 1 for blanked beams 3: Logical value = same as neighbour beam with lower beam number 4: Logical value = same as neighbour beam with higher beam number
Start beam blanking area 1	2104	4	t16U		RW	1	MAX_ BEAM	1	Start beam of blanking area
End beam blanking area 1	2104	5	t16U		RW	1	MAX_ BEAM	1	End beam of blanking area
Function blanking area 2	2104	6	t16U		RW	0	4	0	0: No beams blanked 1: Logical value 0 for blanked beams 2: Logical value 1 for blanked beams 3: Logical value = same as neighbour beam with lower beam number 4: Logical value = same as neighbour beam

									with higher beam number
Start beam blanking area 2	2104	7	t16U		RW	1	MAX_ BEAM	1	Start beam of blanking area
End beam blanking area 2	2104	8	t16U		RW	1	MAX_ BEAM	1	End beam of blanking area
Function blanking area 3	2104	9	t16U		RW	0	4	0	0: No beams blanked 1: Logical value 0 for blanked beams 2: Logical value 1 for blanked beams 3: Logical value = same as neighbour beam with lower beam number 4: Logical value = same as neighbour beam with higher beam number
Start beam blanking area 3	2104	10	t16U		RW	1	MAX_ BEAM	1	Start beam of blanking area
End beam blanking area 3	2104	11	t16U		RW	1	MAX_ BEAM	1	End beam of blanking area
Function blanking area 4	2104	12	t16U		RW	0	4	0	0: No beams blanked 1: Logical value 0 for blanked beams 2: Logical value 1 for blanked beams 3: Logical value = same as neighbour beam with lower beam number 4: Logical value = same as neighbour beam with higher beam number
Start beam blanking area 4	2104	13	t16U		RW	1	MAX_ BEAM	1	Start beam of blanking area
End beam blanking area 4	2104	14	t16U		RW	1	MAX_ BEAM	1	End beam of blanking area

Code Analysis Settings

Customer specific function

Parameter	Index (Hex.)	Subindex (Hex.)	Data type		Access	Min.-Value	Max. Value	Default	Remark
Analysis function	2105	1	T32U		RW	0	1	0	0: Deactivated 1: Activated
Mask	2105	2	T32U		RW	0	MAX_T32U	0	Mask to choose trigger pattern
Value	2105	3	T32U		RW	0	MAX_T32U	0	Trigger pattern
Code	2105	4	T32U		RW	0	MAX_T32U	0	Mask to choose code-values

In- / Outputs – Configuration of Pin 2 and Pin 5

The digital inputs / outputs can be defined as PNP or NPN working. Thus applying to all I/Os simultaneously.
Details see appendix C:

Parameter	Index (Hex.)	Subindex (Hex.)	Data type	Access	Min.-Value	Max. Value	Default	Remark
Digital IO switching level	2150		Bool	RW	0	1	1	0: Transistor NPN 1: Transistor PNP
Configuration Pin 2 (function)								
Configuration of In- /Outputs: Pin 2 and/or 5								
Pin 2: Output Function	2151	1	t08U	RW	0	3	0	0: Deactivated 1: Switching output (area 1..32) 2: Warning output 3: Trigger output
Pin 2: Input Function	2151	2	t08U	RW	0	2	0	0: Deactivated 1: Trigger input 2: Teach input
Pin 2: Switching level	2151	3	t08U	RW	0	1	0	0: Normal –light switching 1: Inverted – dark switching
Pin 2: Selection Input / Output	2151	4	t08U	RW	0	1	1	0: Output 1: Input
Configuration Pin 5 (function)								
Pin 5: Output Function	2152	1	t08U	RW	0	3	0	0: Deactivated 1: Switching output (area 1..32) 2: Warning output 3: Trigger output
Pin 5: Input Function	2152	2	t08U	RW	0	2	0	0: Deactivated 1: Trigger input 2: Teach input
Pin 5: Switching level	2152	3	t08U	RW	0	1	0	0: Normal –light switching 1: Inverted – dark switching
Pin 5: Selection Input / Output	2152	4	t08U	RW	0	1	1	0: Output 1: Input

Digital Output Pin 2 Settings

Up to 4 timer functions configurable. Max. time period are 65 sec.
Output has to be assigned to an area 1-32.For Pin 2 = Index 2155sub3 resp. Pin 5 = Index 2156sub4
Activate the selected area by entering 1 at corresponding position in 32 bit word. Ascending from right with area 01.
Details see appendix C:

Operation mode of time unit	2155	1	t08U	R/W	0	4	0	0: Deactivated 1: ON delay 2: OFF delay 3: Pulse stretching 4: Spike supression
Delay time for defined operation mode	2155	2	t16U	R/W	0	MAX_ T16U		0…65535[ms]
Area mapping 32..1 (logical OR)	2155	3	t32U	R/W	0	MAX_ T32U	0	Logical OR interconnection for mapping areas to output

Digital Output Pin 5 Settings

Operation mode of time unit	2156	1	t08U	R/W	0	4	0	0: Deactivated 1: ON delay 2: OFF delay 3: Pulse stretching 4: Spike supression
Delay time for defined operation mode	2156	2	t16U	R/W	0	MAX_ T16U		0…65535[ms]
Area mapping 32..1 (logical OR)	2156	3	t32U	R/W	0	MAX_ T32U	0	Logical OR interconnection for mapping areas to output

Area Configuration

How to configure up to 32 areas in manual way. Configuration of area: Define condition to ensure that area will be logical 1 or 0. If working in diagonal- or cross-beam mode,insert number of logical beams.Details see appendix A:

Parameter	Index (Hex.)	Subindex (Hex.)	Data type		Access	Min.-Value	Max. Value	Default	Remark
Configuration area 1	2170								
Area	2170	1	t08U		RW	0	1	0	0: Deactivated 1: Activated
Logic conditions	2170	2	t08U		RW	0	1	0	0: Normal – light switching 1: Inverted – dark switching
Start beam	2170	3	t16U		R/W	1	0xFFFE	1	1 ….65534
End beam	2170	4	t16U		RW	1	0xFFFE	1	1 ….65534
Number of beams for condition ON	2170	5	t16U		RW	0	MAX_BEAM	0	0 … 1776
Number of beams for condition OFF	2170	6	t16U		RW	0	MAX_BEAM	0	0 … 1776
Target center	2170	7	t16U		RW	0	MAX_BEAM	0	0 … 1776
Target width	2170	8	t16U		R/W	0	MAX_BEAM	0	0 … 1776

Parameter	Index (Hex.)	Subindex (Hex.)	Data type		Access	Min.-Value	Max. Value	Default	Remark
Configuration area 2	2171								
Area	2171	1	t08U		RW	0	1	0	0: Deactivated 1: Activated
Logic conditions	2171	2	t08U		RW	0	1	0	0: Normal – light switching 1: Inverted – dark switching
Start beam	2171	3	t16U		R/W	1	0xFFFE	1	1 ….65534
End beam	2171	4	t16U		RW	1	0xFFFE	1	1 ….65534
Number of beams for condition ON	2171	5	t16U		RW	0	MAX_BEAM	0	0 … 1776
Number of beams for condition OFF	2171	6	t16U		RW	0	MAX_BEAM	0	0 … 1776
Target center	2171	7	t16U		RW	0	MAX_BEAM	0	0 … 1776
Target width	2171	8	t16U		R/W	0	MAX_BEAM	0	0 … 1776

All other 30 areas have to be configured in the same way as described in 2170 respectively 2171:

Configuration area 3	2172								
Configuration area 4	2173								
Configuration area 5	2174								
Configuration area 6	2175								
Configuration area 7	2176								
Configuration area 8	2177								
Configuration area 9	2178								
Configuration area 10	2179								
Configuration area 11	217A								
Configuration area 12	217B								
Configuration area 13	217C								
Configuration area 14	217D								
Configuration area 15	217E								
Configuration area 16	217F								
Configuration area 17	2180								
Configuration area 18	2181								
Configuration area 19	2182								
Configuration area 20	2183								
Configuration area 21	2184								
Configuration area 22	2185								
Configuration area 23	2186								
Configuration area 24	2187								
Configuration area 25	2188								
Configuration area 26	2189								
Configuration area 27	218A								
Configuration area 28	218B								
Configuration area 29	218C								
Configuration area 30	218D								
Configuration area 31	218E								
Configuration area 32	218F								

Commands								
**How to split the areas „automatically": **								
Transmit first the argument fort he command and than Index 2200, Subindex 1, Value 8								
Parameter	**Index (Hex.)**	**Subindex (Hex.)**	**Data type**		**Access**	**Min.-Value**	**Max. Value**	**Default**	**Remark**
Command Identifier	2200	1	t16U		RW				Task command during writing access: 0: Start Scan 1: Stop Scan 3: Teach 4: Reboot 5: Reset, deletes the user settings – see annotation page 1. With next power up process is the system starting in factory setting configuration. To reset on factory settings, it´s necessary to send first reset and than reboot command. 6: Save 7: Clear Code 8: Splitting, Segmentation of beam areas
Command Argument	2200	2	t16U		RW				Argument at command 8 (Splitting): How should the beams splitted, or how many areas are needed? Enter number of areas 1 …n: 1: all beams configured to **one** area 2: n=2: beams are splitted into 2 areas, both have same size 3: n=3: beams are splitted into 3 same size areas etc. .. (Bit: 0 -7)
									0: Result of area activ, if **one** beam is interrupted (AND) 1: Result of area activ, if **all** beams are interrupted (OR) (Bit: 8)

0: Result of area activ, if **one** beam is interrupted (AND)
1: Result of area activ, if **all** beams are interrupted (OR)
 (Bit: 8)

Teach-Status

Teach-Status	2400	1	t08S		RO	0	MAX_ T08U		Feedback about last teach result: 0x00: Teach ok 0x01: Teach busy 0x80: Teach error (Bit8 = Errorbit)

Alignment of the light curtains

Alignment level of first and last beam.
Please notice - values are different if function reserve changes..

Parameter	Index (Hex.)	Subindex (Hex)	Data type		Access	Min.- Value	Max. Value	Default	Remark
First Beam Intensity	2404	1	t16U		RO				Signal level at beam no. 1
Last Beam Intensity	2404	2	t16U		RO				Signal level at beam no. n

Process data

Parameter	Index (Hex.)	Subindex (Hex.)	Data type		Access	Min.-Value	Max. Value	Default	Remark
Processdata selection: *FIB/FNIB (first interrupted / not interupted beam),* *LIB/LNIB (last interrupted / not interrupted beam),* *TIB/TNIB (total interrupted / not interrupted beams),* *Area Out 1-16 resp. 17-32, Digital In- Outputs*									
First Interrupted Beam (FIB)	2405		t16U		RO				Number of first interrupted beam
First Not Interrupted beam (FNIB)	2406		t16U		RO				Number of first not interrupted beam
Last Interrupted Beam (LIB)	2407		t16U		RO				Number of last interrupted beam
Last Not Interrupted Beam (LNIB)	2408		t16U		RO				Number of last not interrupted beam
Total Interrupted Beams (TIB)	2409		t16U		RO				Summary of total interrupted beams
Total Not Interrupted Beams (TNIB)	240A		t16U		RO				Summary of total not interrupted beams
Code LoWord (CLW)	240B		t16U		RO				Customer specific solution
Code HiWord (CHW)	240C		t16U		RO				Customer specific solution
Area Output LoWord (ALW)	240D		t16U		RO				Logical output of first 16 areas
Area Output HiWord (AHW)	240E		t16U		RO				Logical output of area 17 - 32
Switching status of digital IO	240F		t16U		RO				Status image of pin 2 and pin 5

CML sensor status	2411		t16U	RO				Bit 0-11: Scan number of one measurement cycle; Bit 12-13: reserved; Bit 14: 1= Event, (Set if status has changed) Reason for a event can be checked at Index 2162 Bit 15: 1 = valid measuring result
Beamstream	2412	1	t16U [111]	RO				Read-out status of all beams -------------------------------- Read-out beam 1-16 -------------------------------- One object contains 16 light beams -------------------------------- There is signed status of a interrupted beam respectively not interrupted beam in a bit.
		2	t16U	RO				Read-out beam 17 – 32
		3 …	t16U …	RO ….				Read-out beam 33 – 48 …
		6F	t16U	RO				Read-out beam 1761 - 1776 Beam n up to (n+15)

Status

Information about status of light curtain

Parameter	Index (Hex.)	Subindex (Hex)	Data type		Accessf	Min.-Value	Max. Value	Default	Remark
Device Status	2162		t16S		RO			0	0: Normal function 1: Teach failure 2: Internal Temp./Voltage monitoring 3: Invalid configuration 4: Hardware failure 5: Voltage failure 24V 6: Transmitter and receiver inconsistent 7: Missing connection to transmitter
RX Error Field	2600		t16U		RO				Only internal diagnostic
KX Error Field	2601		t16U		RO				Only internal diagnostic

Remarks:
t08U = type 8bit unsigned
t16U = type 16bit unsigned
t16S = type 16bit integer
MAX-BEAM = max. number of beams
MAX_T08U = max. 8bit unsigned
MAX_T16U = max. 16bit unsigned
MAX_T32U = max. 32bit unsigned

Appendix A:

Example to read out 64 beams:

Mapping of TPDO1 looks following:

MAPPINGENTRY1	0x24120110	-> mapped is Index 0x2412 SubIndex 01 Length of mapped object is 16bit
MAPPINGENTRY2	0x24120210	-> mapped is Index 0x2412 SubIndex 02 Length of mapped object is 16bit
MAPPINGENTRY3	0x24120310	-> mapped is Index 0x2412 SubIndex 03 Length of mapped object is 16bit
MAPPINGENTRY4	0x24120410	-> mapped is Index 0x2412 SubIndex 04 Length of mapped object is 16bit

The 32bits must be read in following way (301 Profil 301_v04020005_cor3.pdf page 142 Figure 73: Structure of TPDO mapping)
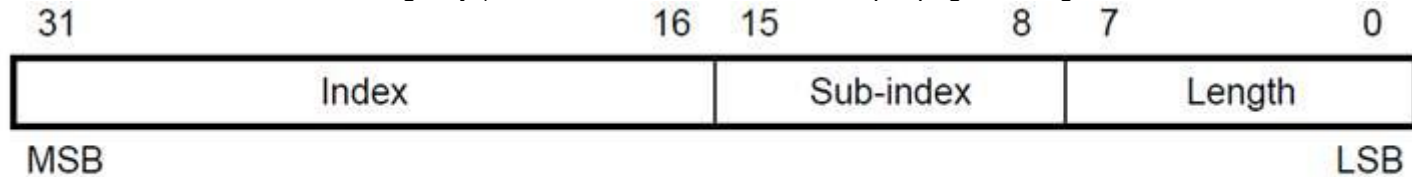
Figure 73: Structure of TPDO mapping

It´s possible to map per PDO 4 x 16bit objects → 64 beams

Into the PDO´s can be mapped all data which are listed under headline „process data" (Index >2405)

Appendix B:
Example: Activation and deactivation of blanking areas.

Example: Autom. configuration and acivation of 2 blanking areas by teach

How to configure 2 blanking areas by plc:

1) 0x2104sub01: to 2 (required number of blanking areas = 2 blanking areas allowed)
2) 0x2104sub02: to 1 = activ (blanking-ares automatically configured by teach)
3) 0x2104sub03: to 2 (Logical value 1 for blanked beams)
4) 0x2104sub06: to 2 (Logical value 1 for blanked beams)
5) 0x2200sub01: value 3 (Teach)

The internal processor calculates the values of objects 0x2104sub04 and 0x2104sub05 as well as 0x2104sub07 and 0x2104sub08 and saves the values remanent. With a successful teach are all other objects 0x2104 remanent saved, if 0x2103sub02 is configured to value 0 = Save persistent to Flash

Example: Deactivation of blanking areas

1) 0x2104sub01: to 0 (**No** blanking areas allowed)
2) 0x2104sub02: to 0 (Autoblanking inactiv)
3) 0x2104sub03: to 0 (no beams blanked)
4) 0x2104sub06: to 0 (no beams blanked
5) 0x2200sub01: value 3 (Teach)

To be shure, that all blanking areas are deactivated, it´s necessary that at object 0x2104sub1 until sub E all values set to 0.

Appendix C:
Example: How to setup configured areas (beam 1- 32) to an output (pin 2)
There are different logical functionalities, depending on conditions for beams „ON" and „OFF"

Index	Description / Variables				
2170	**Configuration Area 01**				
2170 Sub 1	Area 01 Value: 1 = Activated				
2170 Sub 2	Logic conditions	**Value: 0** **Normal – light switching**	**Value: 1** **Inverted – dark switching**	Value: 0 Normal – light switching	Value: 1 Inverted – dark switching
2170 Sub 3	Start beam Value:	1	1	1	1
2170 Sub 4	End beam Value:	32	32	32	32
2170 Sub 5	Number of beams for condition ON Value:	32	32	1	1
2170 Sub 6	Number of beams for condition OFF Value:	31	31	0	0
	Digital IO settings				
2151	Configuration Pin 2 (PNPmode)				
2151 Sub 4	Selection input/output Value: 0 = Output				
2151 Sub 3	Switching level Value: 0 = Normal – light switching	Output 1, if all beams are not interrupted. Output 0, if 1 beam interrupted or >1 beam interrupted.	Output 0, if all beams are not interrupted, resp. beam 1-31 are not interrupted. Output 1, only if 32 beams interrupted.	Output 1, if all beams are not interrupted, resp. as long as 1-31 beams are not interrupted. Output 0, if 32 beams interrupted.	Output 0, if all beams are not interrupted. Output 1 as soon as 1 beam is interrupted.
2151 Sub 3	Switching level **Value: 1 = Inverted – dark switching**	**Output 0, if all beams are not interrupted.** **Output 1, if 1 beam is interrupted or >1 beam interrupted.** **OR-Function**	**Output 1, if all beams are not interrupted, resp. 1-31 beams not interrupted.** **Output 0, only if 32 beams interrupted.** **AND-Function**	Output 0, if all beams are not interrupted, resp. as long as 1-31 beams are not interrupted. Output 1, if 32 beams interrupted.	Output 1, if all beams are not interrupted. Output 0, as soon as 1 beam is interrupted.
2151 Sub 1	Output function Value: 1 = Switching output (area 1..32)				

Mapping of configured Area 01 to Pin 2		
2155	Digital Output 2 Settings	
2155 Sub 3	Area mapping 32 …1 (logical or)	0b00000000000000000000000000000001 0x00000001

Mapping of configured Area 08 to Pin 2		
2155	Digital Output 2 Settings	
2155 Sub 3	Area mapping 32 …1 (logical or)	0b00000000000000000000000010000000 0x00000080

Mapping of configured Areas 01 and 08 to Pin 2 (OR)		
2155	Digital Output 2 Settings	
2155 Sub 3	Area mapping 32 …1 (logical or)	0b00000000000000000000000010000001 0x00000081

Mapping of configured Areas 01 v 02 v 08 v 32 to Pin 2 (OR)		
2155	Digital Output 2 Settings	
2155 Sub 3	Area mapping 32 …1 (logical or)	0b10000000000000000000000010000011 0x80000083

Example: Digital output Pin 2 switching, as soon as one beam is interrupted.
(Measuring field length 32 beams)

How to configure pin 2 by plc:

1) 0x2170sub01: to 1 (Area 01 activated)
2) 0x2170sub02: to 0 (Light switching)
3) 0x2170sub03: to 1 (Start beam of area)
4) 0x2170sub04: to 32 (End beam of area)
5) 0x2170sub05: to 32 (Number of beams for condition ON)
6) 0x2170sub06: to 31 (Number of beams for condition OFF)
7) 0x2151sub01: to 1 (Output function = switching output)
8) 0x2151sub03: to 1 (Switching level Inverted)
9) 0x2151sub04: to 0 (Pin 2 = output)
10) 0x2155sub03: to 1 (Bit-Mapping of area 01 to Pin 2)

Appendix D: Hole recognition
Example: Hole detection at a web and signalization of a hole at output pin 2
There are different settings at logical functions. Please take care of the still interrupted beams.

Configuration of beam width and hole size:

Index	Describtion / Variables		
2170	**Configuration area 01**		
2170 Sub 1	Area 01 Value: 1 = Activated	0x01	This area has to be mapped (later on) to output pin 2
2170 Sub 2	Logic condition of area Value: 1 = Inverted – dark switching	0x01	Beams are interrupted depending of web width, therefore logical function is dark switching.
2170 Sub 3	Start beam of area (web) Value:5	5	Beginning at beam no. 5 analysis of hole recognition starts. If it´s not shure, that web is always interrupting beam no. 5, so it will be saver to configure no. 6 or even no. 7
2170 Sub 4	End beam of area (web) Value:25	25	Beginning at beam no. 25 analysis of hole recognition ends. If it´s not shure, that web is always interrupting beam no. 25, so it will be saver to configure no. 24 or even no. 23
2170 Sub 5	Number of beams for condition ON Value:21	21	With this kind of setting, area /output is switching as soon as ≥1 is not interrupted.
2170 Sub 6	Number of beams for condition OFF Value:20	20	
Example for detection from ≥2 not interrupted beams			
2170 Sub 5	Number of beams for condition ON Value:20	20	With this kind of setting, area /output is switching as soon as ≥2 is not interrupted.
2170 Sub 6	Number of beams for condition OFF Value:19	19	
Example for detection from ≥3 not interrupted beams			
2170 Sub 5	Number of beams for condition ON Value:19	19	With this kind of setting, area /output is switching as soon as ≥3 is not interrupted.
2170 Sub 6	Number of beams for condition OFF Value:18	18	

Configuration of related switching output:

Index	Describtion / Variables		
	Switching output configuration		
2151	Configuration Pin 2 (PNP mode)		
2151 Sub 1	Output function Value: 1 = Switching output (area 1..32)	0x00000001	
2151 Sub 3	Switching level Value: 0 = Normal – light switching	Switching level Value: 1 = Inverted – dark switching	Configuration depending of logical behaviour of output
2151 Sub 4	Selection input/output Value: 0 = Output	0x00000000	

Mapping of area to switching output pin 2:

Mapping of configured Area 01 to Pin 2		
2155	Digital Output 2 Settings	
2155 Sub 3	Area mapping 32 …1 (logical or)	0x00000001