

AUTOPOSI PLUS Positioning System

Operating manual

E_48222



Fig. 2: Code Reader PV4071



Fig. 1: Reader head with a 12 x FOC-Coupler

Characteristic features

- Positioning of rail-mounted vehicles and machines
- Positions are identified by optically reading hole coded mounting plates
- Positions can be read up to a travel speed of 360 m/min
- Position accuracy ± 1 mm

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Contents

AUTOPOSI PLUS Positioning System.....	1
1 Identification	4
1.1 Product versions	4
1.2 Name and address of the manufacturer	4
2 Product description	4
2.1 General use.....	4
2.2 Proper use.....	5
2.3 Improper use.....	5
2.4 Safety information.....	5
3 Definition – Technical data	6
4 Operation manual.....	7
4.1 About this technical information	7
4.2 Description of the equipment and the functions	7
4.2.1 General	7
4.2.2 Code reader PV4071GFK	7
4.2.3 Reading head with a fibre glass cable coupling and various built-in parts	8
4.2.3.1 Reading head	8
4.2.3.2 Mounting plate	8
4.2.3.3 Single optic head for fibre optic cables	8
4.2.3.4 Individual lens for fibre optic cables – This lens serves the task of reading the bit information of the positioning plates. There are 4 individually mounted lenses in the Reading head.	8
4.2.3.5 Double optic head for fibre optic cables	8
4.2.3.6 Fibre optic cable with a angular head for connecting the lens to the FOC Coupler	8
4.2.3.7 Coupler to connect fibre optic cables.....	9
4.2.3.8 Heating for Reading heads	9
4.2.3.9 Fibre optic cable with straight connectors for connecting the FOC coupler to the Code reader	9
4.2.4 Detailed descriptions of the AUTOPOSI PLUS and the positioning plate	10
4.2.4.1 Definition of terms and setting of the direction of travel	10
4.2.4.2 Establishing operational readiness – Synchronisation travel.....	10
4.2.4.3 Dip switch – Configuration settings and the supply status on the Code reader	11
4.2.4.4 Notes concerning the different operating modes.....	11
4.2.4.4.1 Operating modes – Definition	11
4.2.4.4.2 Position reports and the meaning of the <NP>, <InP> and <VP> light indicators.....	12

4.2.4.4.3	Description of the 'In front of desired position'	13
4.2.4.4.4	Description of the 'Behind desired position'	14
4.2.4.4.5	Description of the 'In desired position'	15
4.2.4.4.6	Description of the 'Out desired position'	16
4.2.4.5	Pollution warning output and the intensity display on the Code reader	17
4.2.4.6	Error messages	18
4.2.4.7	Description of errors in detail.....	19
4.2.4.8	Microcontroller – Software and operational test.....	20
4.2.5	Fibre optic cables.....	22
4.2.6	Positioning plate	22
4.2.6.1	Dimensions	22
4.2.6.2	A description of the data and cycle bits	22
4.3	<i>Assembly</i>	24
4.4	<i>Assembly notes</i>	25
4.5	<i>Electrical connections for the Code reader</i>	25
4.6	<i>Optical connection for the Code reader</i>	26
4.7	<i>The electrical and optical connection of the Reading head</i>	27
4.7.1	The positions of the transmitters and receivers in the Reading head - Definition.	27
4.7.2	General information	27
4.7.3	Coupler to connect fibre optic cable	28
5	Collection of data sheets	29
6	Maintenance and cleaning	30
7	Decommissioning	30
8	Spare parts.....	30

1 Identification

1.1 Product versions

Code reader	Type PV4071GFK
Reading head	309.789 edition

1.2 Name and address of the manufacturer

Fotoelektrik Pauly GmbH
Wahrbrink 6, D-59368 Werne, Germany

2 Product description

2.1 General use

The function principle of "AUTOPOSI PLUS" is based on the optical fibre system PV4071GFK manufactured by Fotoelektrik Pauly GmbH. With this "AUTOPOSI PLUS" function principle, 6 Optical fibre cable transmitter / receiver light barriers are arranged in a U-shaped housing so that a code plate can interrupt and release the light barrier beams. The U-shaped housing is supplied by the supplier and must fulfill the "AUTOPOSI PLUS" function principle. Out of the 6 light barriers, 3 light barriers on the left and 3 light barriers on the right are arranged as a group in the U-shaped housing (Reading head). The horizontal distance between the two light barrier groups are largely determined by the dimensions of the code plate. The code plate itself has certain dimensions and hole patterns that are necessary for coding the position number, and for the evaluation process. If the Reading head moves over a code plate, the light beam interruptions and releases are sequentially recorded by the control unit i.e. Code reader PV4071GFK that is

equipped with opto-electrical converters, and evaluated using a programmed process. The result of this evaluation is made available via the various electrical interfaces for further processing in the control unit. With the "AUTOPOSI PLUS" function principle, a machine moving on rails can be positioned at a specific location. The overall functionality of the Code reader PV4071GFK is described in section 4.

The AUTOPOSI PLUS positioning equipment is mostly used on the type of vehicles/machines found in a coking plant, which are moved around on rails – the pusher machine, the charge car, the transfer car and the quench car.

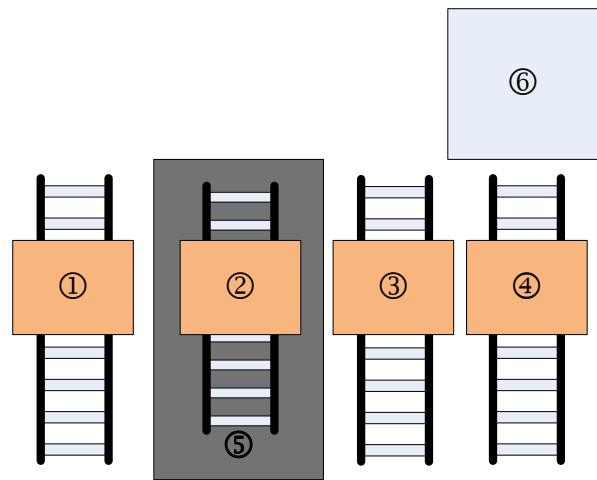


Fig. 2.1: An example showing rail-mounted vehicles / machines in a coking plant

- ①: Pusher Machine
- ②: Charge Car
- ③: Transfer Car
- ④: Quench Car
- ⑤: Coke Battery
- ⑥: Quenching Tower



2.2 *Proper use*

The **AUTOPOSI PLUS – PV4071GFK** positioning equipment has been developed to position rail-mounted vehicles/machines. The respective positioning locations are identified through hole-coded designation panels (positioning plates).

2.3 *Improper use*

The AUTOPOSI PLUS positioning equipment is not to be used for vehicles which can be moved freely and vehicles which do not run on rails.

2.4 *Safety information*

-  The operator/installer must get to know the safety rules which apply to his operational area and keep to them. This also applies both to the installation which is to be carried out as well as the laying of the cable and wiring.
-  Installation and connection work at the Code-reader PV4071GFK may be done only in a current-less state.

3 Definition – Technical data

Code reader PV4071GFK	
Housing	Al base plate and PC cover
Weight	approx. 2.5 kg
Supply voltage	24VDC / < 1000 mA without load +24VDC double terminal 1 0V double terminal 2
Switching outputs	
Bit light barriers (forwards/backwards)	2 x PNP transistor, terminal 4 and 5
Clock light barriers (forwards/backwards)	2 x PNP transistor, terminal 3 and 6
Additional clock light barriers (forwards/backwards)	2 x PNP transistor, terminal 42 and 41
Collective pollution warning output	1 x PNP transistor, terminal 50
Output of furnace numbers / error and pollution warning status values	12 x PNP transistor, BCD coded transistor array with a parity bit, terminals 7 to 18
Position and error reports	
In front of desired position <VP>	1 x PNP transistor, terminal 19
In desired position <InP>	1 x PNP transistor, terminal 20
In front of desired position <NP>	1 x PNP transistor, terminal 21
Reading error <LF>	1 x PNP transistor, terminal 22
Control inputs	
Rotary encoder	Pre phase (24VDC), terminal 23, <DrV> Back phase (24VDC), terminal 24, <DrN>
Input 1	<E1> Stimulation input (24VDC on), terminal 51; Activation - used for emitting the pollution status of the light barriers using a code number which is emitted on the BCD-coded transistor array.
Input 2	<E2> Stimulation input (24VDC on), terminal 52; for manufacturing and quality checks.
Potential equalisation	2 x terminal PE
Transmission light	GaAs 850...880 nm, invisible
Interference suppression	Force synchronisation
Signal processing	Microcontroller
Direction recognition	Optical or rotary encoder
Fibre optic cable	Various – up to 40 m length in each case
Operating temperature	-25 °C ... +60 °C
Software status	V1.03
Reading head - 309.789 edition	
Fibre optic light barriers	A total of 6 light barrier channels; 2 x transmitter/receiver with a single fibre optic cable; 4 x transmitter/receiver with a double fibre optic cable.
Fibre optic connections	12 x coupling
Heating	2 heating elements 230VAC / 800W
Temperature sensor	2 x PT100

4 Operation manual

4.1 About this technical information

This operation manual contains information concerning the proper and effective use of the AUTOPOSI PLUS – PV4071GFK positioning equipment. It is part of the delivery package.

The following description of the equipment and function refers to the positioning of rail-mounted vehicles in a coking oven plant.

The agreements/definitions which apply to the direction description are described in 4.2.4.1.

4.2 Description of the equipment and the functions

4.2.1 General

The complete positioning equipment consists of several components:

- The Code reader PV4071GFK.
- The Reading head with various optical und electrical built-in parts.
- The fibre optic connection that connects the Code reader and the Reading head.
- The Code plates: To be supplied by the end user or the technical service provider, and must strictly adhere to the dimensions as per section 4.2.6.

4.2.2 Code reader PV4071GFK



The Code reader PV4071GFK – 6 fibre optic light barriers (transmitter and receiver) can be connected and evaluated on this optoelectronic system. The Code reader supports independent direction detection and has an automated pollution warning and intensity display.

The evaluation process is designed for travelling and positioning speeds up to 360 m/min.

The 6 light barriers serially read a bit stream and/or a cycle synchronisation stream, which is generated on account of the bright/dark crossovers on the positioning plate (plates marked with a hole) when passing.

The hole coded position value (i.e. the oven number) is worked out using this optical reading of the positioning plates. Furthermore, the central positioning of a rail vehicle can be worked out in front of the positioning plates.

The switching statuses of the individual light barriers are made available by means of digital electronic switching outputs. Using the microcontroller's firmware, the current position value and any error numbers are notified via a BCD coded transistor array belonging to the master PLC.

The 'In front of desired position' <VP>; 'In desired position' <InP> and 'Behind desired position' <NP> digital switching outputs deliver current position information with which the master control can generate travel assignments.

The recognised pollution of one of all light barriers leads to a collective report and the switching on of a transistor. If needed, from the master control, it is possible to request the pollution warning status of individual light barriers via the input <E1>.

The pollution warning status of the individual light barriers is emitted to the BCD coded transistor array by means of a status specific code number and in addition, it can be evaluated by the master control.

The switching state of each digital output is additionally indicated by a LED. The Code reader is designed using an open construction method and executed in such a way, that it can be installed in a cabinet.

4.2.3 Reading head with a fibre glass cable coupling and various built-in parts

4.2.3.1 Reading head



Reading head - The Reading head is formed in a U-shape. The 6 transmitter / receiver light barriers are arranged between the two U journals. The Reading head is mounted on a rail-mounted machine in such a way, that when the Reading head is moved, stationary mounted positioning plates (reading plates) pass between the U journals. The Reading head reads the hole marks of the positioning plates. At the same time, the spacing arrangement of the light barriers supports the fine positioning of coking plant machines. The transmitter / receiver light path to the Code reader is established using fibre optic extension cables. The connection to the fibre optic extension cable takes place via a special 12-pin FOC coupling.

4.2.3.2 Mounting plate



Mounting plate – The mounting plate serves the task of mounting the individual and double lenses in the Reading head. There are 4 mounting plates mounted in the Reading head.

4.2.3.3 Single optic head for fibre optic cables



4.2.3.4 Individual lens for fibre optic cables – This lens serves the task of reading the bit information of the positioning plates. There are 4 individually mounted lenses in the Reading head.

4.2.3.5 Double optic head for fibre optic cables



Double lens for fibre optic cables – These lenses serve the task of reading the cycle information from the positioning plates. There are 4 double lenses mounted in the Reading head.

4.2.3.6 Fibre optic cable with a angular head for connecting the lens to the FOC Coupler



Fibre optic cable with an angular head – This fibre optic cable serves the task of making an optical connection between the lenses and the coupling. In each case, the Reading head houses 4 mounted individual and double cables each with a length of 0.9m.

4.2.3.7 Coupler to connect fibre optic cables



Coupler to connect fibre optic cables – The coupler serves the task of directly connecting 12 fibre optic pairs. There is a mounted coupler in the Reading head.

4.2.3.8 Heating for Reading heads



Heating for Reading heads – The heating serves the task of directly heating the interior sides of the Reading head. There are 2 mounted heating elements in the Reading head.

4.2.3.9 Fibre optic cable with straight connectors for connecting the FOC coupler to the Code reader



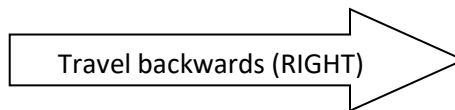
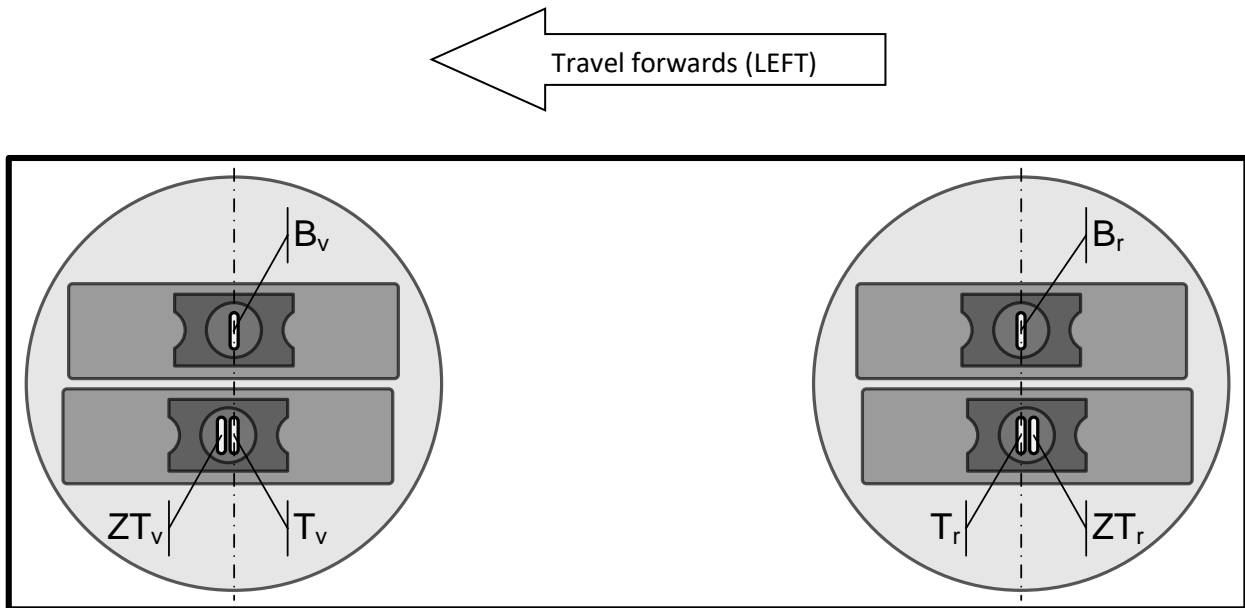
Fibre optic cable with straight connectors – They are needed to optically connect the coupler on the Reading head and the code reader. The technical information regarding the optical fibre cables are available in the attached datasheet E_81001. Please note that although various cable lengths are mentioned in the datasheet, for this AUTOPOSI PLUS system, cable lengths of 6m, 10m or 15m only are recommended.

Fotoelektrik Pauly – Light barriers

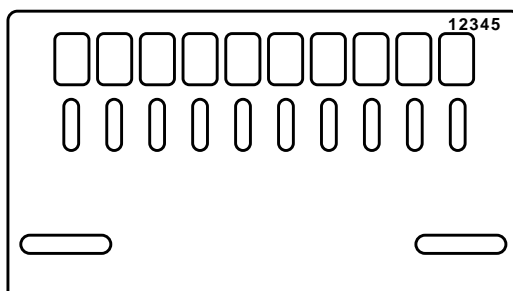
4.2.4 Detailed descriptions of the AUTOPOSI PLUS and the positioning plate

4.2.4.1 Definition of terms and setting of the direction of travel

Principle arrangement of the light barriers in a Reading head and the directions of travel.



Forward light barriers		Backward light barriers	
Bv	Bit light barrier	Br	Bit light barrier
Tv	Clock light barrier	Tr	Clock light barrier
ZTv	Additional clock light barrier	ZTr	Additional clock light barrier



Positioning plates with an ID number (this corresponds to a coded oven number) which is engraved in the top right corner.

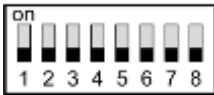
Readable engraving → Front view.

4.2.4.2 Establishing operational readiness – Synchronisation travel

The operational readiness of the positioning system is established after a positioning plate has been passed. This takes place after the supply voltage has been (re-) started following an error message (Error status LED <LF> lights up).

Fotoelektrik Pauly – Light barriers

4.2.4.3 Dip switch – Configuration settings and the supply status on the Code reader



Using the dip switch, it is possible to carry out various configuration settings.

The configuration settings are only adopted after the 'resetting' of the microcontroller. In order to 'reset' the microcontroller, it is necessary to interrupt the supply voltage to the Code reader for a short period (for at least 3 s).

Switch	Meaning	On	Off	Supply status
Switch 1	Operation mode selection	PP2071 Compatibility mode	PV4071 End switch mode	On
Switch 2	Display module	Activated; Operational data are shown on the (optional) display module!	Not activated	Off
Switch 3	Signal inversion for the read error message <LF>	'Low active' read error event message – LED off	'High active' read error event message – LED lights up	Off
Switch 4	-	-	-	Off
Switch 5	-	-	-	Off
Switch 6	-	-	-	Off
Switch 7	Error code output (Oven number > 700 _{Hex})	Not activated - Error code is not specified; Error event-display number = '000'	Activated - Error code is specified; Error event – for the display number, see chapter 4.2.4.6	Off
Switch 8	Direction sensor	Direction recognition using the rotary encoder	Optical direction recognition with the additional light barriers ZTv and ZTr	Off

4.2.4.4 Notes concerning the different operating modes

4.2.4.4.1 Operating modes – Definition

Mode	PP 2071 Standard Positioning mode	PV 4071 End switch mode	PP 2071 Downward compatibility
Dip switch (Switches 2 to 7 are optionally off or on)			
Positioning with	6 light barriers	6 light barriers	The 4 inner light barriers Bv and Tv, as well as Br and Tr, are actively evaluated. (Arrangement of the light barriers in the Reading head upon enquiry.)
Direction recognition	Optically using the additional clock light barriers ZTv and ZTr	Optically using the additional clock light barriers ZTv and ZTr	Using the rotary encoder

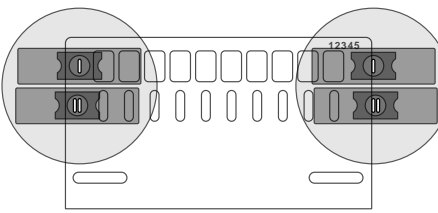
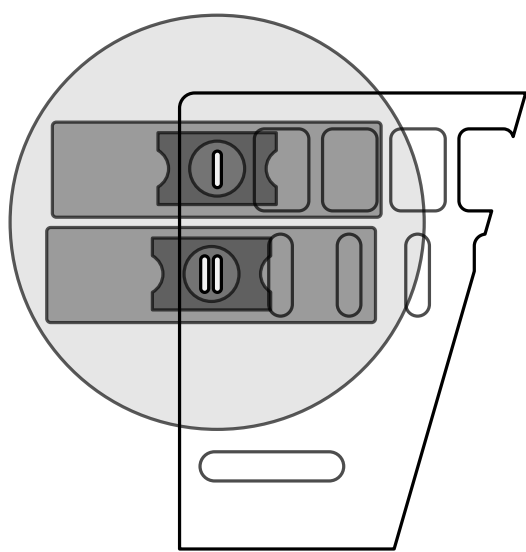
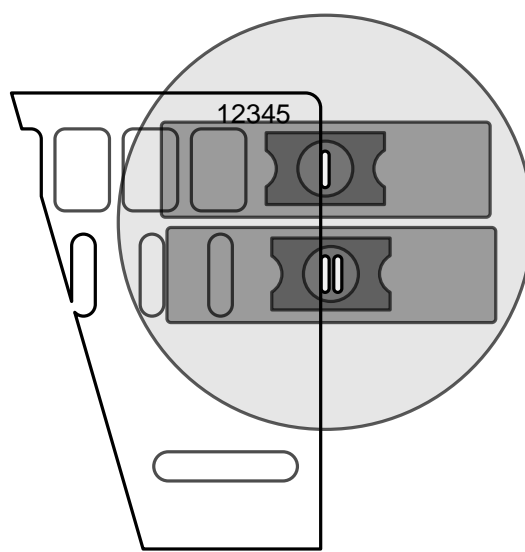
Fotoelektrik Pauly – Light barriers

4.2.4.4.2 Position reports and the meaning of the <NP>, <InP> and <VP> light indicators

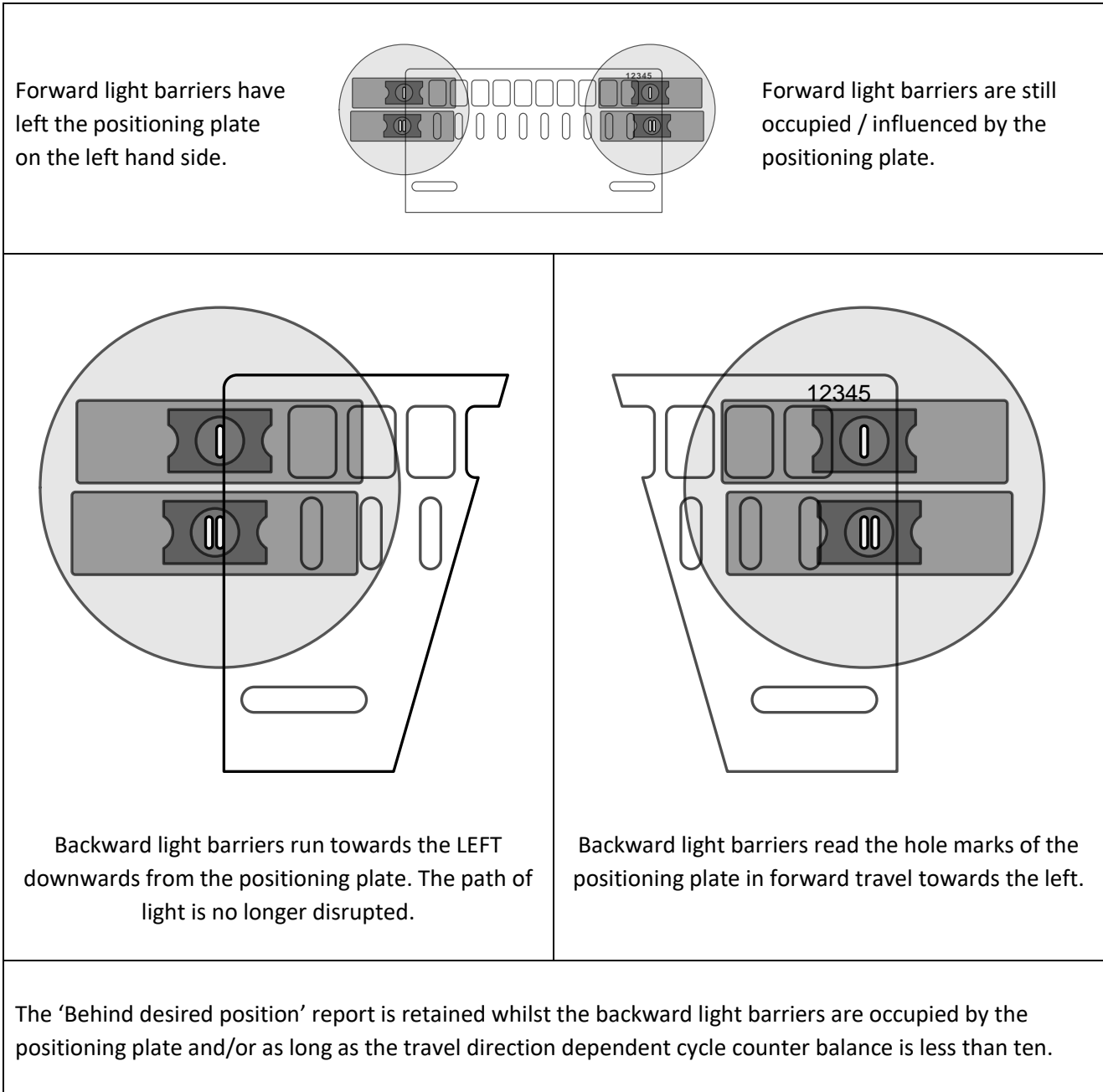
Mode	PP 2071 Standard positioning mode	PV 4071 End switch mode	PP 2071 Downward compatibility
Dip switch (Switches 2 to 7 are optionally off or on)			
Inpos (In desired Position)	NP InP VP 	NP InP VP End switch mode; *1 no errors have occurred NP InP VP End switch mode; *1 There have been errors, which do not stop the function of the end switch.	NP InP VP
Inpos is marginally abandoned as a result of the machine travelling towards the left	NP InP VP ⇒ A corrective journey towards the right is necessary in order to find the Inpos again!	NP InP VP ↔ The corrective journey depends on the status of the additional clock light barrier <ZTv>!	NP InP VP ⇒ A corrective journey towards the right is necessary in order to find the Inpos again!
Inpos is marginally abandoned as a result of the machine travelling towards the right	NP InP VP ⇐ A corrective journey towards the left is necessary in order to find the Inpos again!	NP InP VP ↔ The corrective journey depends on the status of the additional clock light barrier <ZTr>!	NP InP VP ⇐ A corrective journey towards the left is necessary in order to find the Inpos again!
Inpos is abandoned fully as a result of the machine travelling towards the left	NP InP VP ⇒ A corrective journey towards the right is necessary in order to find the Inpos again!	NP InP VP ⇒ A corrective journey towards the right is necessary in order to find the Inpos again!	NP InP VP ⇒ A corrective journey towards the right is necessary in order to find the Inpos again!
Inpos is abandoned fully as a result of the machine travelling towards the right	NP InP VP ⇐ A corrective journey towards the left is necessary in order to find the Inpos again!	NP InP VP ⇐ A corrective journey towards the left is necessary in order to find the Inpos again!	NP InP VP ⇐ A corrective journey towards the left is necessary in order to find the Inpos again!
Handling errors – Error display <LF> ON	No INPOS display	End switch function INPOS display is only actuated through <InP> = ON	No INPOS display

*1 The limit switch function (InP-outp. active) is always executed when all 6 light barriers are darkened or do not deliver any signal.

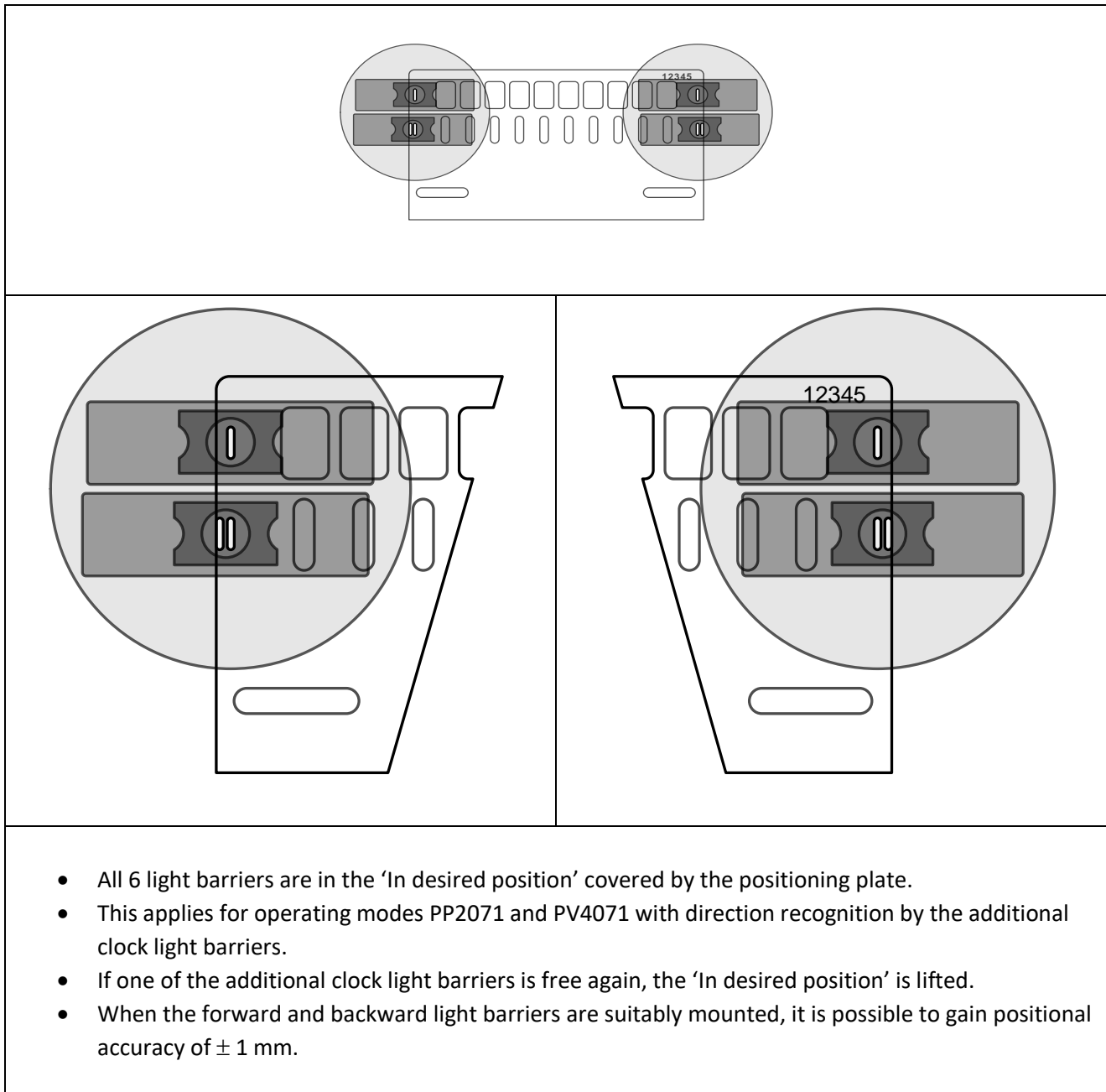
4.2.4.4.3 Description of the 'In front of desired position'

<p>Forward light barriers are still occupied / influenced by the positioning plate.</p>		<p>Backward light barriers have left the positioning plate on the right hand side.</p>
 <p>Forward light barriers read the hole marks of the positioning plate in backward travel towards the right.</p>	 <p>Backward light barriers run towards the RIGHT downwards from the positioning plate. The path of light is no longer disrupted.</p>	
<p>The 'In front of desired position' report is retained whilst the forward light barriers are occupied by the positioning plate and/or as long as the travel direction dependent cycle counter balance is less than ten.</p>		

4.2.4.4.4 Description of the 'Behind desired position'

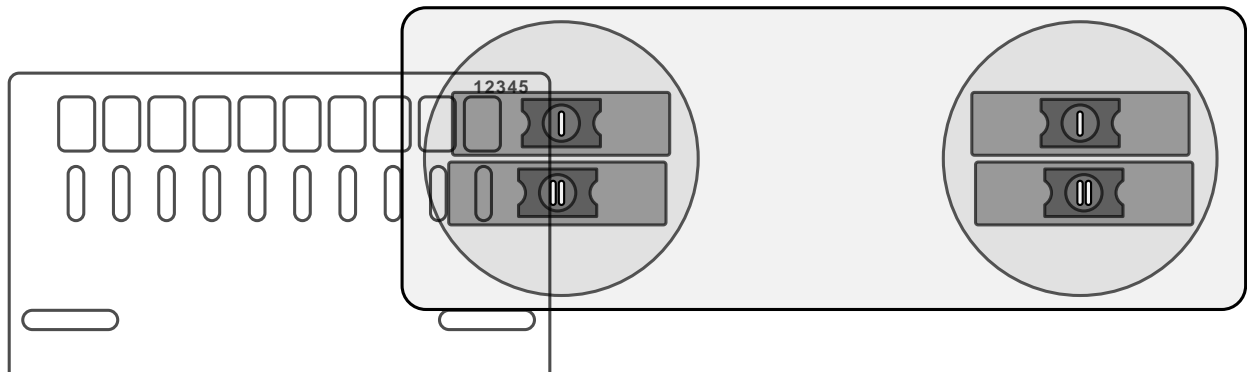


4.2.4.4.5 Description of the 'In desired position'

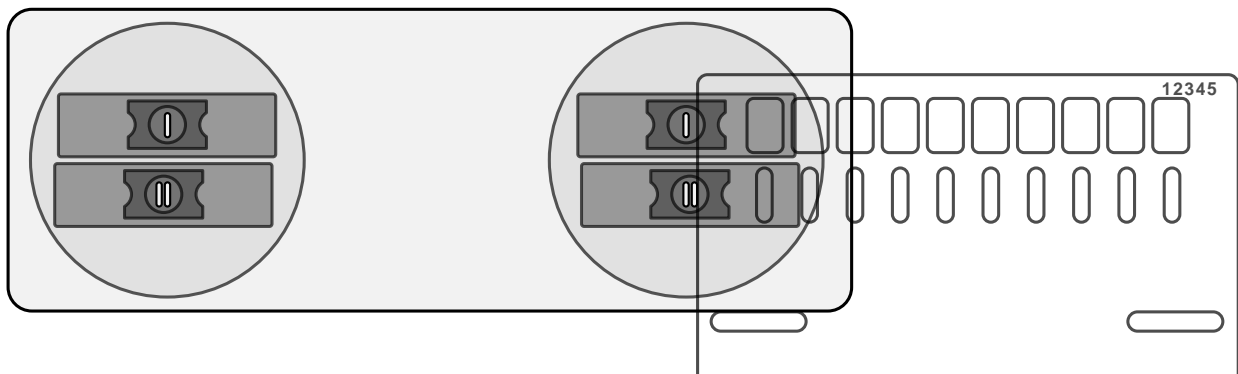


4.2.4.4.6 Description of the 'Out desired position'

The Reading head is right of the positioning plate



The Reading head is left of the positioning plate



- All 6 light barriers are free. No positioning plate occupy a light barrier.
- The oven number which was last approached is shown as long as a new positioning plate is reached and the three forward or backward light barriers are occupied.

4.2.4.5 Pollution warning output and the intensity display on the Code reader






In order for the unit to work with large power reserves, it is necessary to align the 6 light barriers in the Reading head. The alignment can be designed simply as gauge blocks are built into the Reading head. It is possible to align these gauge blocks optimally with the aid of spacers. The performance of the individual light barriers is continually monitored and visualised. A damping of the optical path between the transmitter and receiver of each individual light barrier may be caused by cumulative deposits of dust on the optical surfaces.

Any loss of efficiency can be read directly on the channel specific intensity display (DIANA). The current occupancy and/or damping status / pollution warning status is shown using the channel specific status indicators, yellow, red and green.

Recognised losses of efficiency are shown in a joint report <VK> (terminal 50). It is possible to enquire about the pollution warning status directly from the master PLC via the input <E1>. Via the BCD-coded transistor array, it is then possible to determine the requested pollution warning status for each individual light barrier.

Meaning of the channel specific light displays:

	Yellow	Red	Green	Meaning
	off	off	on	Light barrier is not occupied – free light path
	off	on	off	Light barrier is occupied
	off	on	on	Light barrier is dampened or misaligned – pollution is the possible cause
	on	on	on	Light barrier is dampened or misaligned – If this state occurs outside a positioning plate, servicing staff need to work on the unit
	Intensity display – DIANA (Digital analogue display) All LEDs light up when the alignment is good and the light path is undampened – Normal state. As a result of misalignment or pollution, fewer LEDs light up.			
 Power	Reception sensitivity – Setting potentiometer It is possible to set the reception sensitivity using the setting potentiometer. The optimum reception sensitivity is set in the supplied state. The potentiometer is then in a left stop position, i.e. the potentiometer is rotated counter-clockwise as far as it will go. In order to retain highest possible reserves of power, even in the case of pollution, a reduction in the reception sensitivity is not advised.			

Fotoelektrik Pauly – Light barriers

4.2.4.6 Error messages

Terminal number	22	18	17	16	15	14	13	12	11	10	9	8	7	Meaning
Significance - BCD coded	LF	Par	BCD 10 ²			BCD 10 ¹				BCD 10 ⁰				
			400	200	100	80	40	20	10	8	4	2	1	
Status	1	0	0	0	0	0	0	0	0	0	0	0	0	after power on
Status	0	0	0	0	0	0	0	0	0	0	0	0	0	After the 1st synchronisation
Oven and error status values														
1 to 511	0	0/1	x	x	x	x	x	x	x	x	x	x	x	Oven number
701	1	0	1	1	1	0	0	0	0	0	0	0	1	Error 701
703	1	0	1	1	1	0	0	0	0	0	0	1	1	Error 703
704	1	0	1	1	1	0	0	0	0	0	1	0	0	Error 704
705	1	0	1	1	1	0	0	0	0	0	1	0	1	Error 705
711	1	0	1	1	1	0	0	0	1	0	0	0	1	Error 711
712	1	0	1	1	1	0	0	0	1	0	0	1	0	Error 712
714	1	0	1	1	1	0	0	0	1	0	1	0	0	Error 714
721	1	0	1	1	1	0	0	1	0	0	0	0	1	Error 721
722	1	0	1	1	1	0	0	1	0	0	0	1	0	Error 722
724	1	0	1	1	1	0	0	1	0	0	1	0	0	Error 724
731	1	0	1	1	1	0	0	1	1	0	0	0	1	Error 731
732	1	0	1	1	1	0	0	1	1	0	0	1	0	Error 732
734	1	0	1	1	1	0	0	1	1	0	1	0	0	Error 734
741	1	0	1	1	1	0	1	0	0	0	0	0	1	Error 741
742	1	0	1	1	1	0	1	0	0	0	0	1	0	Error 742
744	1	0	1	1	1	0	1	0	0	0	1	0	0	Error 744
Pollution warning status values (The output takes place on LSB to MSB, if the stimulation input E1 is at high level. In the case of a polluted LB, a 1 (high level) is emitted.)														
Terminal number	22	18	17	16	15	14	13	12	11	10	9	8	7	Meaning
Significance - BCD coded	LF	Par	BCD 10 ²			BCD 10 ¹				BCD 10 ⁰				
			400	200	100	80	40	20	10	8	4	2	1	
7c0 hex.bis 7ff hex	0/1	0/1	MSB 1	1	1	1	1	0/1	0/1	0/1	0/1	0/1	LSB 0/1	
	Current status dynamic	Static=1						ZTv LB	Tv LB	Bv LB	Br LB	Tr LB	ZTr LB	
7c0 hex	0/1	0/1	MSB 1	1	1	1	1	0	0	0	0	0	LSB 0	No pollution

Legend:

LB = Light barrier

LF = Read error (not inverted!)

Par = Parity

4.2.4.7 Description of errors in detail

701	The number of cycles which are read is not plausible. No secure position (Oven number) can be emitted.
703	The oven number which is read by the backward light barriers does not correspond with the parity bit.
704	The oven number which is read by the forward light barriers does not correspond with the parity bit.
705	Actuating the sensor on the system circuit board forces a synchronisation of the system. (Synchronisation: When a positioning plate is overrun or when the positioning plate travels from the out desired position the In desired position and back again to the out desired position.)
712 714	The Reading head leaves the positioning plate via the backward light barriers and is located in the out desired position. If the light path of Tr LB or Br LB is disrupted, error 71x is emitted. The lowest three bits of the BCD unit position represent the defective light barrier(s). Output BCD 2= 1 → Error occurred on Tr LB. Output BCD 4= 1 → Error occurred on Br LB. Special case: If the light path of Tv LB is disrupted in this Reading head position, 722 is emitted.
722 724	The Reading head leaves the positioning plate via the forward light barriers and is located in the out desired position. If the light path of Tv LB or Bv LB is disrupted, error 72x is emitted. The lowest three bits of the BCD unit position represent the defective light barrier(s). Output BCD 2= 1 → Error occurred on Tv LB. Output BCD 4= 1 → Error occurred on Bv LB. Special case: If the light path of Tr LB is disrupted in this Reading head position, 712 is emitted.
731 732 734	The Reading head reads the positioning plate with the forward light barriers and moves in the direction of the in desired position. In each cycle (ZTv LB = light and Tv LB = dark -> bright) a check is made to see if the light path of the backward light barriers (ZTr LB , Tr LB, Br LB) is free. In the case of an error, value 73x is emitted. The lowest three bits of the BCD unit position represent the defective light barrier(s). Output BCD 1= 1 → Error occurred on ZTr LB. Output BCD 2= 1 → Error occurred on Tr LB. Output BCD 4= 1 → Error occurred on Br LB.

741 742 744	<p>The Reading head reads the positioning plate with the backward light barriers and moves in the direction of the in desired position. In each cycle (ZTr LB = light and Tr LB = dark -> bright) a check is made to see if the light path of the backward light barriers (ZTv LB , Tv LB , Bv LB) is free. In the case of an error, value 74x is emitted. The lowest three bits of the BCD unit position represent the defective light barrier(s).</p> <p>Output BCD 1= 1 → Error occurred on ZTv LB. Output BCD 2= 1 → Error occurred on Tv LB. Output BCD 4= 1 → Error occurred on Bv LB.</p>
7c0 hex up to 7ff hex	<p>The pollution warning status is sent to the BCD outputs when the E1 pollution warning status stimulation input is at the high level (Ub). The polluted light barriers are identified with 1 (LED lights up/ high level). If there is no pollution, value 7c0 Hex is emitted.</p> <p>Output BCD 1= 1 → Pollution occurred on ZTr LB. Output BCD 2= 1 → Pollution occurred on Tr LB. Output BCD 4= 1 → Pollution occurred on Br LB. Output BCD 8= 1 → Pollution occurred on Bv LB. Output BCD 10= 1 → Pollution occurred on Tv LB. Output BCD 20= 1 → Pollution occurred on ZTv LB.</p>

4.2.4.8 Microcontroller – Software and operational test

The test functions are carried out when the button is actuated on the system circuit board for at least up to 3 seconds after the supply voltage has been reached (when the supply voltage is switched on).

The next test function is accessed by re-pressing the button.

The test routine can only be abandoned by resetting the microcontroller interrupting the supply voltage.

1st test: Chaser light

All outputs controlled by the processor are sequentially set to high-level (whereby the current output-LED briefly lights up).

Sequence (from left to right):

LF	NP	InP	VP	Par	BCD400
BCD200	BCD100	BCD80	BCD40	BCD20	BCD10
BCD8	BCD4	BCD2	BCD1.		

(from terminal 22 to terminal 7)

2nd test: Output of the dip switch setting and pollution

The dip switch signals and the pollution warning control device are switched to the outputs.

Input signal	→Output	Input signal	→Output
1st dip switch on	→LED BCD 80 is dark	LB-ZTr polluted	→LED BCD 100 is dark
2nd dip switch on	→LED BCD 40 is dark	LB-Tr polluted	→LED BCD 200 is dark
3rd dip switch on	→LED BCD 20 is dark	LB-Br polluted	→LED BCD 400 is dark
4th dip switch on	→LED BCD 10 is dark	LB-Bv polluted	→LED Par is dark
5th dip switch on	→LED BCD 8 is dark	LB-Tv polluted	→LED VP is dark

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Input signal	→Output	Input signal	→Output
6th dip switch on	→LED BCD 4 is dark	LB-ZTv polluted	→LED InP is dark
7th dip switch on	→LED BCD 2 is dark	No function	→LED NP always bright
8th dip switch on	→LED BCD 1 is dark	No function	→LED LF always bright

3rd test: The switching statuses of the input signals are switched to the outputs.

Switch components are controlled by the dip switches.

No function	→ LED BCD 1 is dark
LB-ZTv light path is open	→ LED BCD 2 is bright
LB-Tv light path is open	→ LED BCD 4 is bright
LB-Bv light path is open	→ LED BCD 8 is bright
LB-Br light path is open	→ LED BCD 10 is bright
LB-Tr light path is open	→ LED BCD 20 is bright
LB-ZTr light path is open	→ LED BCD 40 is bright
Overall polluting warning contact (VK) (active, one yellow LED is bright)	→ LED BCD 80 is bright

Input RS232, Pin 1	→ BCD 100	(Internal use)
Input ISP, Pin 1	→ BCD 200	(Internal use)
Input ISP, Pin 3	→ BCD 400	(Internal use)
Input ISP, Pin 9	→ Par	(Internal use)
Input E2 is on the + signal	→ VP LED is bright	
Input E1 is on the + signal	→ InP LED is bright	
Input DrN is on the + signal	→ NP LED is bright	
Input DrV is on the + signal	→ LF LED is bright	

Switch	Function	On	Off
1st dip switch	Output RS232, Pin 2	approx. +8.5 Volt	approx. -8.5 Volt
2nd dip switch	Transmitter power reduction forward LB	active	inactive
3rd dip switch	Transmitter power reduction backward LB	active	inactive
4th dip switch	None		
5th dip switch	None		
6th dip switch	None		
7th dip switch	Yellow status LED on the microcontroller	bright	dark
8th dip switch	Green status LED on the microcontroller	bright	dark

4th test: Counter

A counter is started which will count from 0 to 799. The counter status will be sent to the BCD outputs.

After 799, the counter starts with 000 again.

Fotoelektrik Pauly – Light barriers

4.2.5 Fibre optic cables

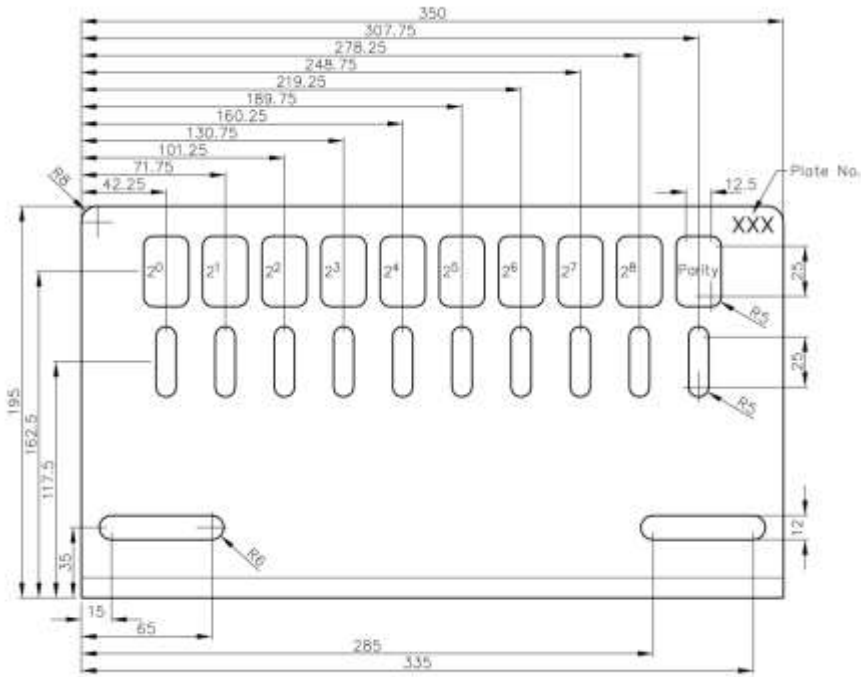
Fibre optic connection cables:

These connect the Reading head equipped with a Coupler with the Code reader PV4071GFK. Various lengths are available (see Section 8)

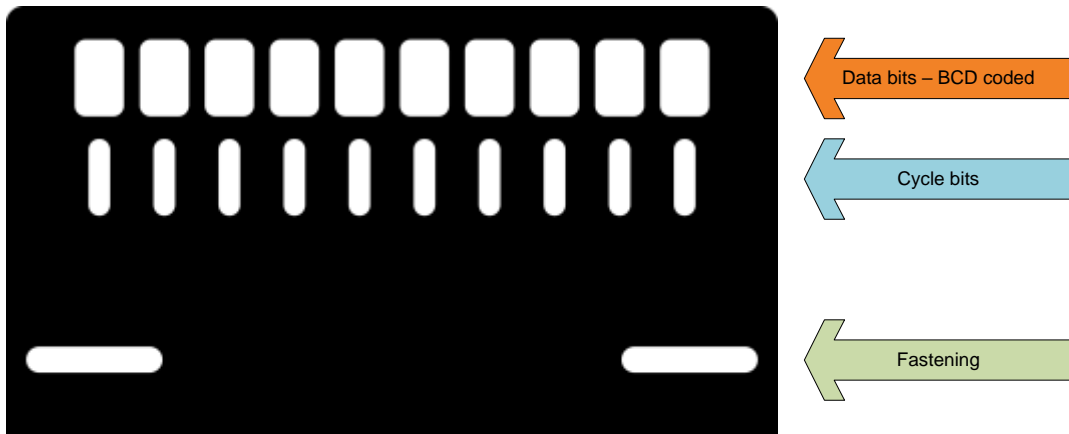
An operational test of the fibre optic lengths can take place by coupling visible light to ascertain the connectivity between the light barriers and the Code reader.

4.2.6 Positioning plate

4.2.6.1 Dimensions

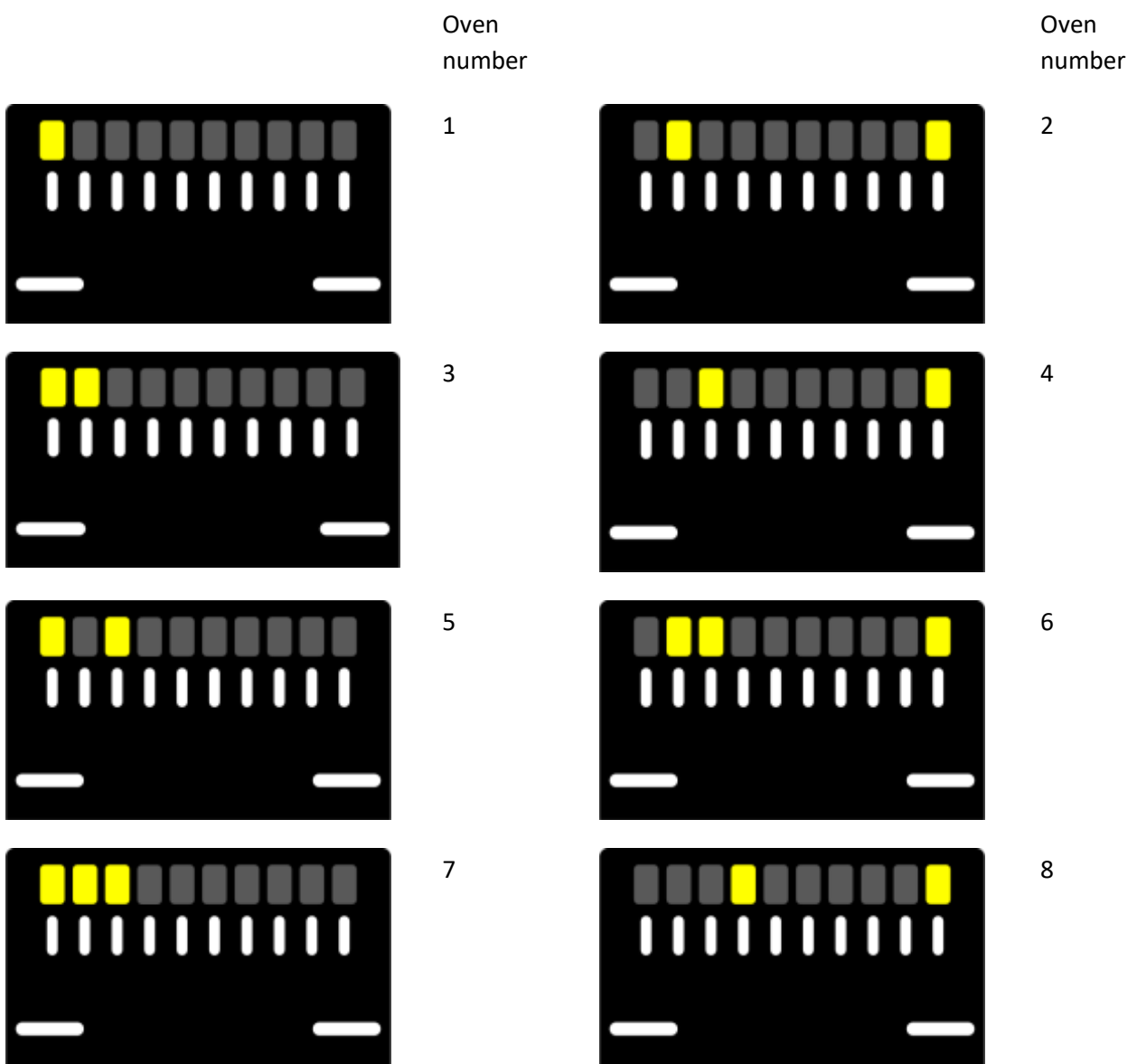


4.2.6.2 A description of the data and cycle bits



Fotoelektrik Pauly – Light barriers

Example of positioning plates with oven numbers 1 to 8



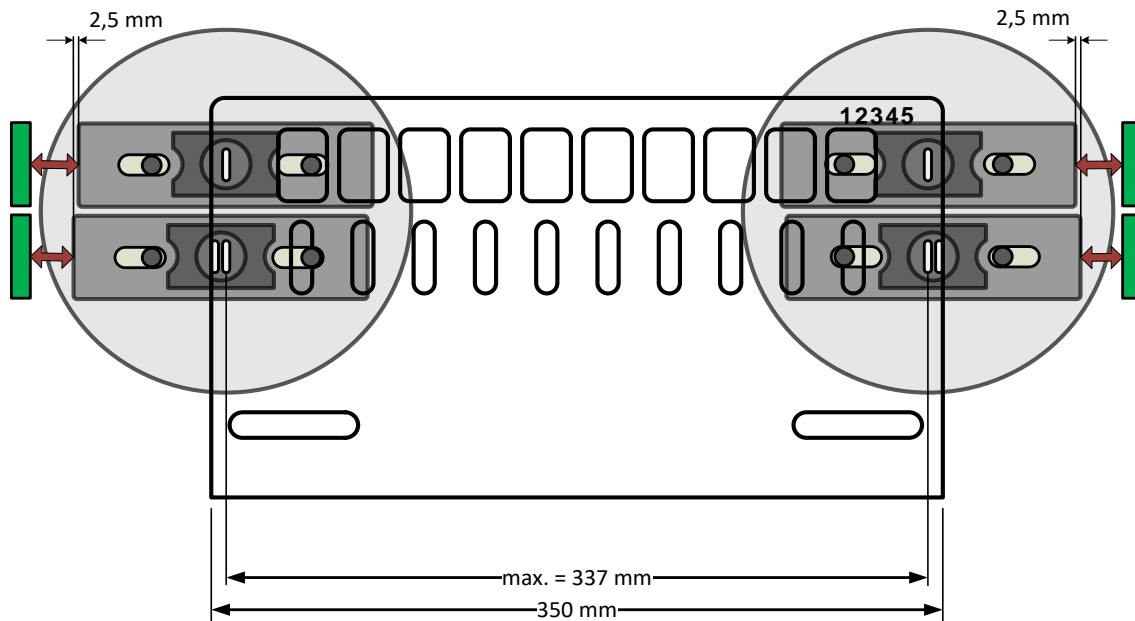
4.3 Assembly

In the Reading head, the light barriers are arranged with reference to the positioning plate and they represent the possible positional accuracy of the Reading head. The positional accuracy is significantly determined by the long hole assembly of the built in optical heads. Appropriate aids include spacers which establish the distance to the gauge blocks – ⇄.

‘In desired position’ is reached when all 6 light barriers are covered by positioning plate. The diagram shown applies to the Reading head 309.789 edition.

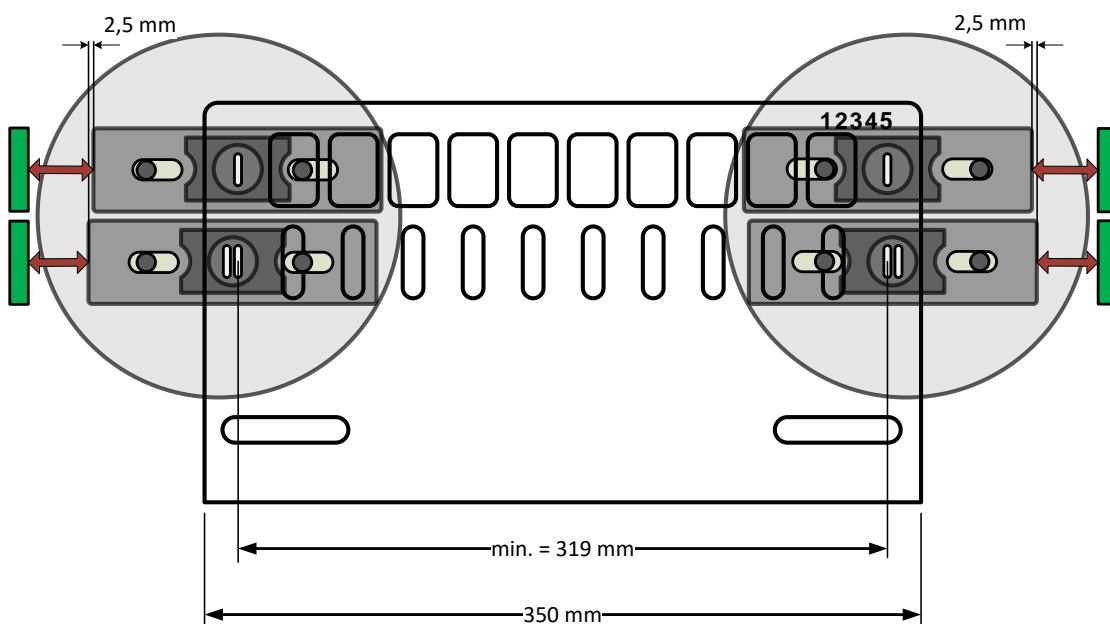
Maximum distance between the forward and backward light barriers; narrow spacers ⇄

→ positional accuracy ≤ 1 mm





Minimum distance between the forward and backward light barriers; wide spacers ⇄

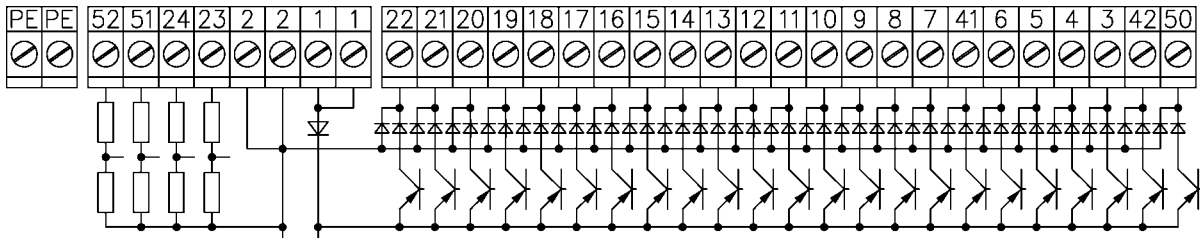
→ positional accuracy ≤ 15 mm







4.4 Assembly notes

-  The Code reader PV4071GFK is only intended for switch cabinet installation
-  Where possible, the Code reader PV4071GFK should be installed downwards with the optical connections. This avoids the influence of dirt during the set-up phase.

4.5 Electrical connections for the Code reader



Terminal	Name	Data direction	Function
1	+24V	Input	Supply voltage 24V DC
2	0V	Input	Supply voltage 0V
3	Tr	Output	Light barrier 'clock backwards'
4	Br	Output	Light barrier 'bit backwards'
5	Bv	Output	Light barrier 'bit forwards'
6	Tv	Output	Light barrier 'clock forwards'
7...17	BCD xxx	Output	Oven number/error code
18	Par	Output	Control bit 'parity'
19	VP	Output	Before desired position
20	InP	Output	In desired position
21	NP	Output	After desired position
22	LF	Output	Read error
23	DrV	Input	Pre phase rotary encoder
24	DrN	Input	Back phase rotary encoder
41	ZTv	Output	Light barrier 'Additional clock forwards'
42	ZTr	Output	Light barrier 'Additional clock backwards'
50	VK	Output	Pollution warning output
51	E1	Input	Stimulation input - Pollution status
52	E2	Input	Input 2
PE	PE	Input	Earth conductor

-  Installation and connection work at the Code-reader PV4071GFK may be done only in a current-less state.
-  In the supplied state, terminal '2' (0 V) and 'PE' (earth conductor) are bridged. *Only* remove this bridge when actively monitoring the earth conductor
-  The outputs are current-limited (60mA) and short-circuit proof.
Output voltage: High ~ 22 V, Low = open
-  The inputs are designed for 24 V DC.
Input voltage: High 16...24 V DC, Low = 0...5 V DC or open

4.6 Optical connection for the Code reader



During installation, no dirt or water should come into contact with the connection and/or the end section of the fibre optic cable. If this happens, dirt or water can lead to a reduction in power or the operation not being sealed properly!

The fibre optic transmitter and receiver cables which are used for the light barriers should be wired to the circuit board with appropriate connections.

To do this, slide the first fibre optic cable end section (M10) as far as it goes into the converter bank (*until you feel the limit stop*) and with the appropriate setscrew (mounted into the converter bank) fasten it.



Insert the cable as far as it goes (until you feel the limit stop) and screw it down tightly

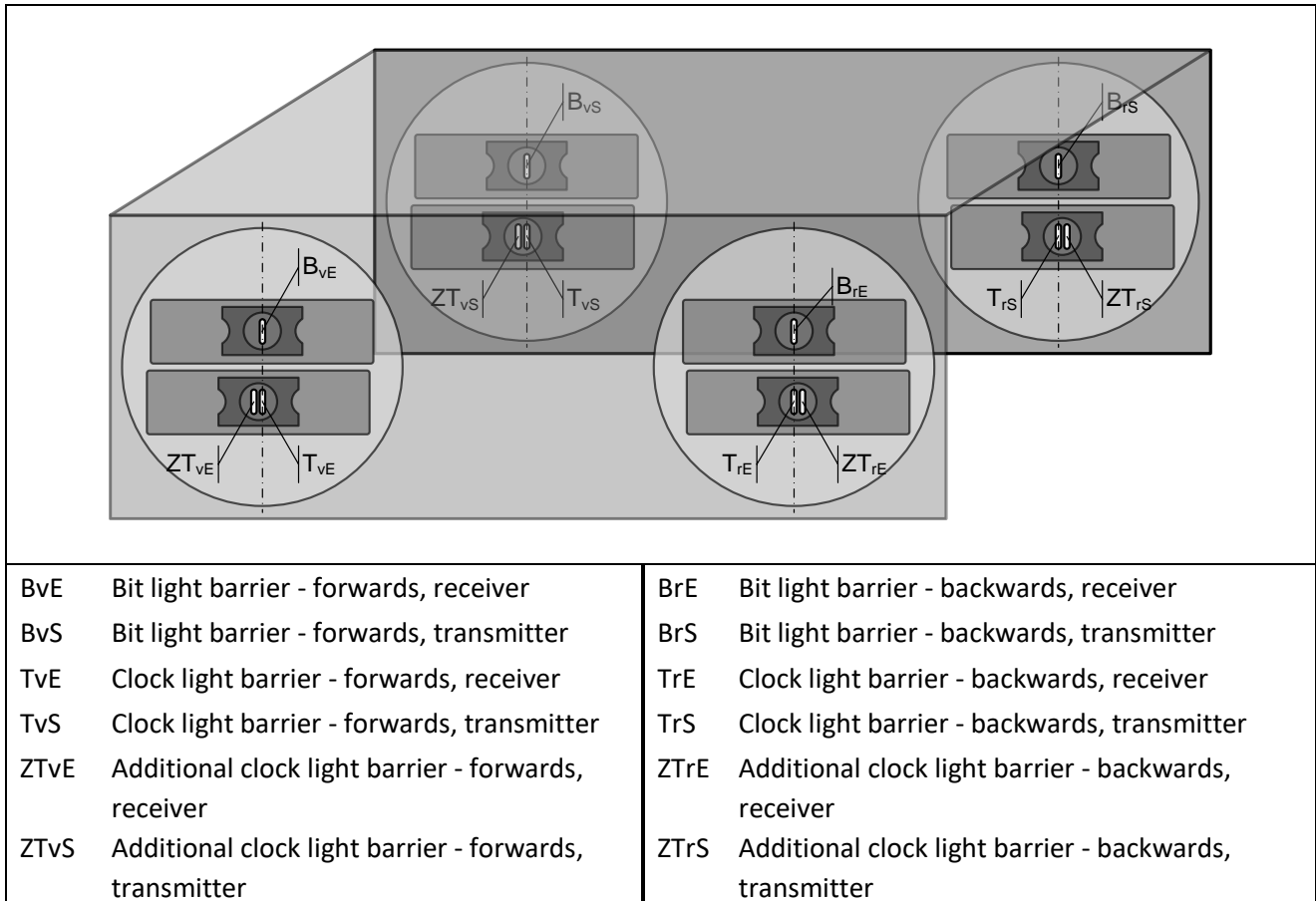
Continue in this fashion until the 12th fibre optic cable end section!



Insert the cable as far as it goes (until you feel the limit stop) and screw it down tightly

4.7 The electrical and optical connection of the Reading head

4.7.1 The positions of the transmitters and receivers in the Reading head - Definition.



4.7.2 General information

- 👉 During installation, no dirt or water should come into contact with the coupling and/or the end section of the fibre optic cable. If this happens, dirt or water can lead to a reduction in power or the operation not being sealed properly!
- 👉 Document E_891128.pdf shows the detailed plan of the electrical and optical connections.
- 👉 The heating connections are located in the Reading head.
In order to connect the heating it will be necessary to dismount the Coupler.

4.7.3 Coupler to connect fibre optic cable



The coupler to connect fibre optic cable (Type: Kupp 12 GFK O-4071) serves the task of directly connecting 12 pairs of fibre optic cables. The coupler is a fixed part of the 309.789 edition Reading head.

An 8 mm fibre optic cables connection is necessary for this.

Sealing takes place via 24 o-rings which are located in the coupling.

Slide the first fibre optic cable end section into the coupler as far as it goes (until you feel the metallic limit stop) and with the appropriate setscrew, fasten it:



Insert the cable as far as it goes (until you feel the metallic limit stop) and screw down tightly.

In addition, slide the second fibre optic cable end section into the coupler as far as it goes (until you feel the metallic limit stop) and in turn fasten this end section with the appropriate setscrew:



Insert the cable as far as it goes (until you feel the metallic limit stop) and screw down tightly.

Continue in this fashion with the other 10 fibre optic cables!

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Fibre optic cable – List of connections:


Reading head	Fibre optic cable type	12 FOC coupler slot	Fibre optic cable type	Code reader
ZTvS	Double: Angle → Ø8	1	Single: Ø8 → M10	ZTvS
TvS		2	Single: Ø8 → M10	TvS
TrS	Double: Angle → Ø8	3	Single: Ø8 → M10	TrS
ZTrS		4	Single: Ø8 → M10	ZTrS
BvS	Single: Angle → Ø8	5	Single: Ø8 → M10	BvS
BrS	Single: Angle → Ø8	6	Single: Ø8 → M10	BvS
BvE	Single: Angle → Ø8	7	Single: Ø8 → M10	BvE
BrE	Single: Angle → Ø8	8	Single: Ø8 → M10	BrE
ZTvE	Double: Angle → Ø8	9	Single: Ø8 → M10	ZTvE
TvE		10	Single: Ø8 → M10	TvE
TrE	Double: Angle → Ø8	11	Single: Ø8 → M10	TrE
ZTrE		12	Single: Ø8 → M10	ZTrE

Further connection details can be found in the document 'Reading head wiring diagram' E_891128.pdf.

5 Collection of data sheets


Part number	Type	Description	Document
4822	PV4071GFK & accessories	Cover sheet & contents	E_482220.pdf
4822	PV4071GFK	Cover sheet - Code reader PV4071GFK	E_48221.pdf
4822	PV4071GFK	Operating instructions - Code reader PV4071GFK (this document)	E_48222.pdf
8019	GFK 2W xy TVA	Datasheet - Fibre optic cable GFK 2W xy TVA	E_80191.pdf
8039	GFK W xy TVA	Datasheet - Fibre optic cable GFK W xy TVA	E_80391.pdf
8100	GFK xy VA	Datasheet - Fibre optic cable GFK xy VA	E_81001.pdf
8130	GFK xy Si VA	Datasheet - Fibre optic cable GFK xy Si VA	E_81301.pdf
8190	O-4071	Datasheet - Mounting plate O-4071	E_81901.pdf
8191	O-4071-1-GFK	Datasheet - Single optic head O-4071-1-GFK	E_81911.pdf
8192	O-4071-2-GFK	Datasheet - Double optic head O-4071-2-GFK	E_81921.pdf
8190...8192	O-4071 & O-4071-1-GFK & O-4071-2-GFK	Assembly instructions - Mounting plate unit	E_81902.pdf
8194	Kupp12 GFK O-4071	Datasheet - Coupler Kupp12 GFK O-4071	E_81941.pdf
8194	Kupp12 GFK O-4071	Installation instructions - Coupler Kupp12 GFK	E_81942.pdf
8911	Reading head 307.144 & 309.789	Wiring diagram – Reading head 307.144 & 309.789	E_891128.pdf
8913	Reading head 309.789	Dimensional drawing for the Reading head 309.789	E_891329.pdf
8914	Rotary encoder PDI1058-3600	Datasheet – Rotary Incremental Encoder PDI1058-3600	E_89141.pdf
8915	PHz01	Datasheet Heating element PHz01	E_89151.pdf


6 Maintenance and cleaning

 The tasks of cleaning the optical surfaces and checking the operational condition should only be performed by a trained expert.

Depending on the level of dust in the operational environment, the optical surfaces of the Reading head should be cleaned (removal of dust) at appropriate intervals.

A soft, lint-free, dampened cloth should be used to clean the optical surfaces. If necessary, a small amount of commercially available rinsing agent (washing up liquid) can be added to the water that is used for cleaning.

 Do not use any alcohol or other solvent-based cleaner.

 Avoid scratches on the optical surfaces.

7 Decommissioning

The equipment must be properly disposed of after its service life. When decommissioning, follow local laws concerning the disposal of electronic equipment.

8 Spare parts

Part number	Type	Description	Remark
4822	PV4071GFK	Code reader	
8190	O-4071	Mounting plate for optical heads	
8191VA	O-4071-1-GFKVA	Single optic head (stainless steel)	
8192VA	O-4071-2-GFKVA	Double optic head (stainless steel)	
8194VA	Kupp 12 GFK O-4071VA	Coupler 12 x Ø8 connection	
8915	PHz01	Heating element	
8913	Reading head 309.789	Reading head for a Code reader	
8914	Rotary encoder PDI1058-3600	Rotary encoder for a Code reader	
8023TVA	GFK2W13TVA	Double fibre optic cable 0.9m	300 °C
8043TVA	GFKW13TVA	Fibre optic cable 0.9m	300 °C
8108VA	GFK08VA	Fibre optic cable 6m	200 °C
8113VA	GFK15VA	Fibre optic cable 15m	200 °C
8115VA	GFK13VA	Fibre optic cable 25m	200 °C
8112VA	GFK20VA	Fibre optic cable 40m	200 °C
8138VA	GFK08SiVA	Fibre optic cable with a silicone casing 6m	200 °C
8143VA	GFK15SiVA	Fibre optic cable with a silicone casing 15m	200 °C
8145VA	GFK25SiVA	Fibre optic cable with a silicone casing 25m	200 °C

D-59368 Werne, 15.03.2021

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