SmartPlug

Plug-in intelligence

MFI Inverter
from Page 682

- *Inverts NPN to PNP or PNP to NPN devices, and N.C./N.O. also adjustable*

MFC Counter
from Page 684

- *Adjustable counter (pulses or intervals) between 1 … 65535 ms*
- *Count parts*
- *Parts from results*
- *Flip-flop*

MFT Timer
from Page 686

- *Adjustable on-delay or drop-out delay between 1 … 65535 ms*

MFF Frequency
from Page 688

- *Adjustable frequency monitoring between 15 … 1000 Hz*
- *Monitoring standstills*
- *Monitoring rotary speeds*
- *Detection of accumulations*

SmartPlug saves you from using expensive timing elements or supplementary control elements because SmartPlug makes the sensor smarter. Connected with SmartPlug, your sensor takes over additional control functions. As a timer, counter or inverter, for monitoring frequency, or for on-delay or drop-out delay. Adjustment of the classic MFC, MFI, MFT and MFF takes place using teach-in via a control line. The new universal genius MFU is programmable with a PDA (palm) or notebook via an infrared interface. Every variant of SmartPlug can be cascaded so that counters and timers, for example, can be combined.

SmartPlug is suitable for sensors from all producers with standardised M12 plugs; a special adapter cable is available for connection to an M8 plug. SmartPlug accommodates its refined electronics in a small, easy-to-handle 60 x 20 mm plug housing. With its maximum output current of 400 mA, the SmartPlug can also be used as a switching amplifier. SmartPlug: plug-in intelligence!

SmartPlug is also compatible with sensors from other producers.

TYPICAL SENSOPART

- Very easy handling
- No installation costs, due to direct connection between sensor and cable
- Reasonably priced compared to conventional function modules
- Assists PLC programmes in time-critical functions
- Can be used as a switching amplifier up to 400 mA
- User-friendly due to simple teach-in
- MFU model offers comfortable programming via infrared interface and/or notebook (USB)

MFW Wipe Function
from Page 690

- *Adjustable wipe function for falling or rising edges; time calculation 1 … 65535 ms*
- *Signal expansion*
- *Filter*

MFU Universal
from Page 692

- *All-in multifunctional switching device programmable via USB*
- *Freely programmable counter, inverter and timer*
- *Accessories for parameterisation available*

made in Germany

SmartPlug – Product Overview		
	Special features	Page
MFI (Inverter)	Inverts NPN to PNP or PNP to NPN devices, N.C./N.O. also adjustable	682
MFC (Counter)	Adjustable counter (pulses or intervals) between 1 … 65535	684
MFT (Timer)	Adjustable on-delay or drop-out delay between 1 … 65535 ms	686
MFF (Frequency)	Adjustable frequency monitoring between 15 … 1000 Hz	688
MFW (Wipe Function)	Adjustable wipe function for falling or rising edges; time range 1 … 65535 ms	690
MFU (Universal)	All-in multifunctional switching device programmable via USB	692

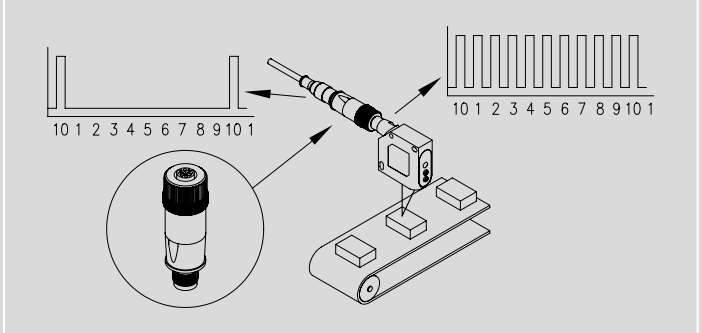
SmartPlug

System description

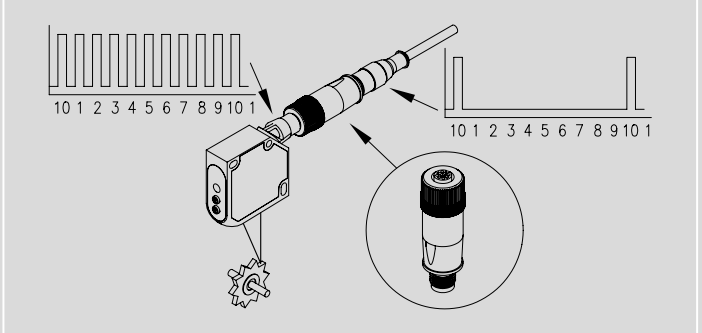
TYPICAL SENSOPART

- The smart solution for simple tasks
- Switching amplifier up to 400 mA
- Simple setting via external teach-in wire
- Compatible with all sensor producers
- Compatible with all methods of function: optic, ultrasonic, inductive, capazitive
- No supplementary installation required
- A product that evolved from practical use for practical use

SmartPlug MFC application:
counting parts in a container with the F 50
Switching takes place after every tenth object – a typical task in packaging.



SmartPlug MFC application:
counting gear teeth with the F 50
The rotations of a gearwheel can also be counted.



SmartPlug MFI 12 Inverter

Depending on the SmartPlug Type, the SmartPlug MFI 12 Inverter converts the signal of the connected sensor from PNP to NPN (MFI 12 PN4) or vice versa (MFI 12 NP4). The output function can also be switched via the control line (NO/NC).

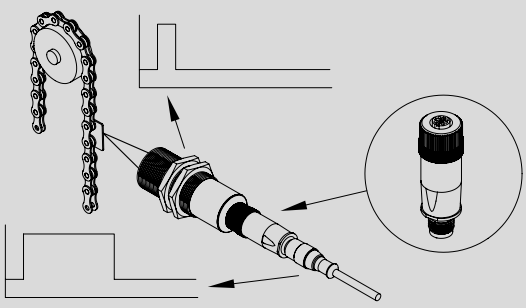
SmartPlug MFC 12 Counter

The SmartPlug MFC 12 Counter counts the output pulses of the connected sensor. The sensor's output pulse is switched through on reaching the preselected number. The preselected number can be set via teach-in.

SmartPlug MFT 12 Timer

The SmartPlug MFT 12 Timer supplements the connected sensor with the time function on-delay or drop-out delay. Both functions can be set via teach-in. The default setting is a drop-out delay of 100 ms. With this setting, the SmartPlug can be used directly for lengthening very short switching signals so they are suitable for PLCs.

SmartPlug MFT application:
chain detection with the FMS 30
The SmartPlug causes an on-delay or drop-out delay so that the PLC can evaluate the rapid movement of the chain.



SmartPlug MFF 12 Frequency Monitor

The SmartPlug MFF 12 monitors the frequency of the incoming signals. The SmartPlug's output is activated if the actual frequency falls below about 5% of the programmed level, and the sensor's signal is put through. Counting the input frequency on the SmartPlug; monitoring standstills; monitoring rotary speed; detecting accumulations.

SmartPlug MFW 12 Wipe Function

The SmartPlug MFW 12 Wipe Function reacts to the rising or falling edge (adjustable via external signal) of the input signal from the sensor and generates a switching pulse. The duration of the switching pulse, during which the SmartPlug holds the switching output of the signal, can be adjusted between 1 … 65535 ms.

SmartPlug MFU Universal

The all-rounder! Whether as a counter, inverter or timer, for monitoring frequency or for on-delay and drop-out delay – the SmartPlug MFU offers universal use compatible with all sensors from familiar producers, and communicates with a PC or notebook via an infrared interface. A USB adapter is available for simple programming via the notebook. All functions can be combined with one another. In addition to configuration, the user-friendly software allows reading out of the set values and the storage (and thus re-use) of settings already made.

SmartPlug MFI

NPN/PNP converter / inverter; adjustable N.O./N.C.

CE

PRODUCT HIGHLIGHTS

- Direct adaptation between sensor and connection cable
- Adjustable N.C. / N.O. function
- Simple settings via control line
- No additional installations necessary
- Switching frequency of up to 10 kHz
- Switching amplifier up to 400 mA

Functions	
Indicator	LED, red
Adjustment possibilities	PNP / NPN conversion and N.C. / N.O. inversion or NPN / PNP conversion and N.C. / N.O. inversion
Default setting	N.O.

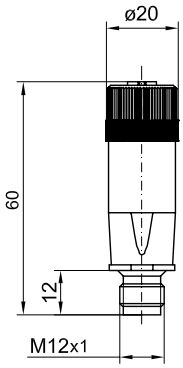
Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC[1]
Power consumption	≤ 10 mA
Input resistance	> 10 kOhm
Input frequency	≤ 10 kHz
Input pulse width	50 µs
Output current, Ie	≤ 400 mA
Protective circuits	Short-circuit protection
Protection Class	2[2]
Switching output	See Selection Table
Standard connection	1 Bn $+U_B$ 3 BU $-U_B$ 4 BK output

Mechanical data	
Dimensions	Ø 20 x 60 mm
Enclosure rating	IP 67[3]
Material, housing	Plastic PBTP / PA
Type of connection: input	M12 x1 socket, 4-pin
Type of connection: output	M12 x1 plug, 4-pin
Ambient temperature: operation	0 … +60 °C
Ambient temperature: storage	-20 … +60 °C
Weight	15 g

[1] 10 % ripple, within U_B [2] Only when connected on both sides [3] With connected IP 67 plug

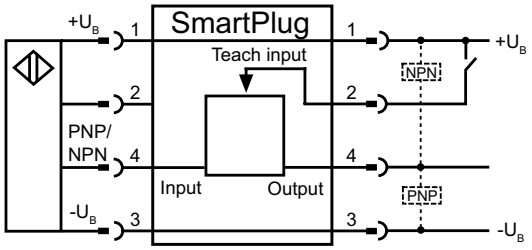
Switching output	Input	Description	Part number	Article number
NPN	PNP	Conversion of PNP sensor to NPN output	MFI 12 PN4	968-21002
PNP	NPN	Conversion of NPN sensor to PNP output	MFI 12 NP4	968-21003

Plug connection



153-00255

Connection, 4-pin



154-00239

Setting N.C./N.O. signal inversion

Setting of signal inversion is achieved via the "Teach Input" and "Input SmartPlug" signals.

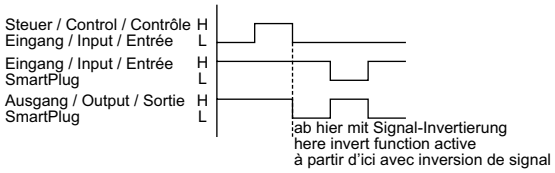
Example:

1. The SmartPlug should invert the sensor signal
   a. Activate sensor (output is active)
   b. Connect and separate Teach input and $+U_B$ (provide $+U_B$ pulse at "Teach Input").
   ➞ FINISHED

   The setting remains even in switched-off state.

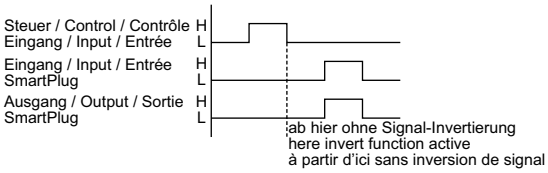
2. The SmartPlug should not invert the sensor signal (default setting)
   a. Do not activate sensor (output is inactive)
   b. Connect and separate Teach input and $+U_B$ (provide $+U_B$ pulse at "Teach Input").
   ➞ FINISHED

Teaching with signal inversion



155-00073

Teaching without signal inversion



155-00074

H = input or output active; L = input or output inactive

SmartPlug MFC

Programmable pulse or interval counter

CE

PRODUCT HIGHLIGHTS

- Direct adaptation between sensor and connection cable
- Counting of pulses or intervals
- Simple settings via external teach-in
- No additional installations necessary
- Switch inverter (N.C./N.O. function)
- Flip-flop (on/off switching)
- Distributor (1 pulse per rotation)
- Number range: 1 … 65535
- Switching amplifier up to 400 mA

Functions	
Indicator	LED, red
Adjustment possibilities	Monitoring standstills, monitoring rotary speeds, detecting accumulations

Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC[1]
Power consumption	≤ 10 mA
Input resistance	> 10 kOhm
Input frequency	≤ 1 kHz
Input pulse width	50 µs
Output current, Ie	≤ 400 mA
Protective circuits	Short-circuit protection
Protection Class	2[2]
Switching output	See Selection Table
Standard connection	1 Bn $+U_B$ 3 BU $-U_B$ 4 BK output

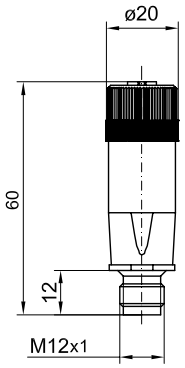
Mechanical data	
Dimensions	Ø 20 x 60 mm
Enclosure rating	IP 67[3]
Material, housing	Plastic PBTP / PA
Type of connection: input	M12 x1 socket, 4-pin
Type of connection: output	M12 x1 plug, 4-pin
Ambient temperature: operation	0 … +60 °C
Ambient temperature: storage	-20 … +60 °C
Weight	15 g

[1] 10 % ripple, within U_B [2] Only when connected on both sides [3] With connected IP 67 plug

Switching output	Part number	Article number
PNP	MFC 12 PP4	968-21000
NPN	MFC 12 NN4	968-21001

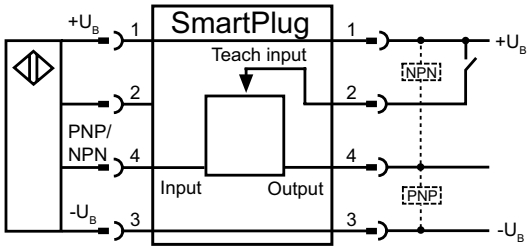
Version: 10/2016. Subject to changes; diagrams similar

Plug connection



153-00255

Connection, 4-pin



154-00239

Settings

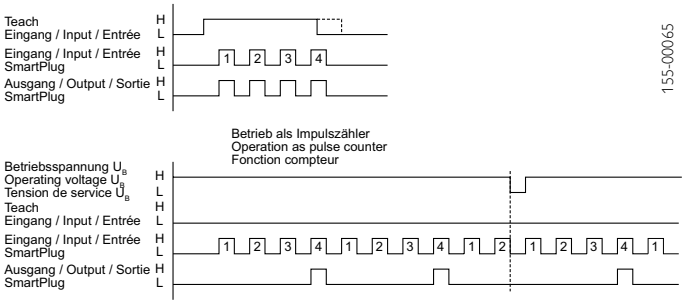
Setting of the preselected number is achieved via the "Teach Input" and "Input SmartPlug" signals.

If, for example, 4 pulses are to be counted, the setting can be carried out as follows (operating voltage is on):

1. Connect Teach Input with $+U_B$
2. Activate sensor 4 times (= 4 events) (the SmartPlug automatically detects 4 pulses at Input SmartPlug)
3. Separate Teach Input from $+U_B$ ➜ FINISHED

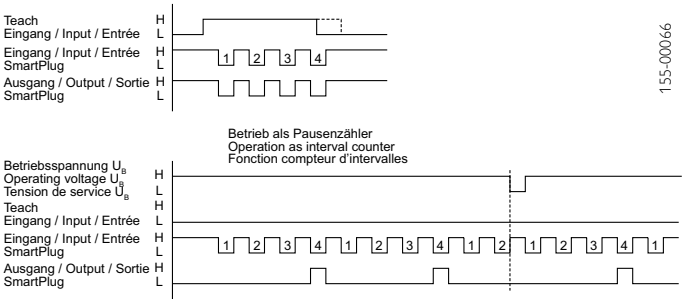
After making this setting, the output of the SmartPlug is active during every fourth sensor signal. The setting is also retained when turned off. The counting process is reset when the operating voltage is switched on again. The default preselected time is 1 (pulse counter).

Teach-in, pulse delay



155-00065

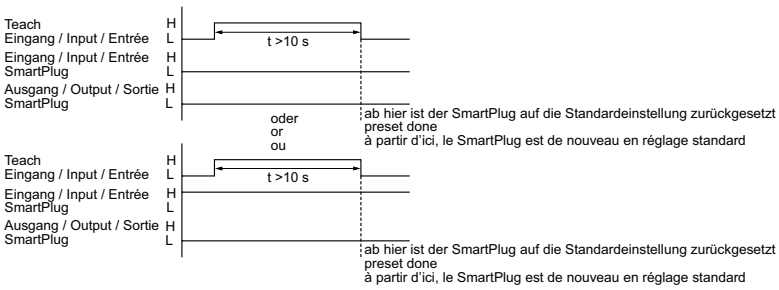
Teach-in, interval counter



155-00066

H = input or output active; L = input or output inactive

Reset to standard setting of 1 pulse counter



155-00075

SmartPlug MFT

Programmable timer for on-delay or drop-out delay

CE

PRODUCT HIGHLIGHTS

- Direct adaptation between sensor and connection cable
- On-delay or drop-out delay teachable
- Simple settings via external teach-in
- No additional installations necessary
- Time range: 1 … 65535 ms
- Switching amplifier up to 400 mA

Functions	
Indicator	LED, red
Adjustment possibilities	On-delay / drop-out delay
Default setting	100 ms drop-out delay

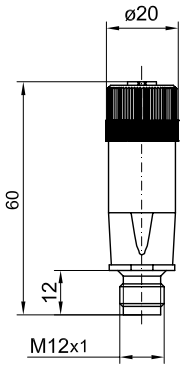
Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC[1]
Power consumption	≤ 10 mA
Input resistance	> 10 kOhm
Input frequency	≤ 10 kHz
Input pulse width	50 µs
Output current, Ie	≤ 400 mA
Protective circuits	Short-circuit protection
Protection Class	2[2]
Switching output	See Selection Table
Standard connection	1 Bn $+U_B$ 3 BU $-U_B$ 4 BK output

Mechanical data	
Dimensions	Ø 20 x 60 mm
Enclosure rating	IP 67[3]
Material, housing	Plastic PBTP / PA
Type of connection: input	M12 x1 socket, 4-pin
Type of connection: output	M12 x1 plug, 4-pin
Ambient temperature: operation	0 … +60 °C
Ambient temperature: storage	-20 … +60 °C
Weight	15 g

[1] 10 % ripple, within U_B [2] Only when connected on both sides [3] With connected IP 67 plug [4] Please define option with your order
[5] Presetting anywhere between 1 … 65535 ms

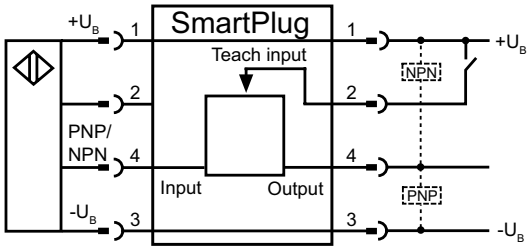
Switching output	Drop-out delay	Part number	Article number
PNP	100 ms	MFT 12 PP4	968-11000
NPN	100 ms	MFT 12 NN4	968-11001
PNP	1 … 65535 ms[4,5]	MFT 12 PP4 t:..	968-11002
NPN	1 … 65535 ms[4,5]	MFT 12 NN4 t:..	968-11003

Plug connection



153-00255

Connection, 4-pin



154-00239

Settings

Setting of the delay period is achieved via the "Teach Input" and "Input SmartPlug" signals.

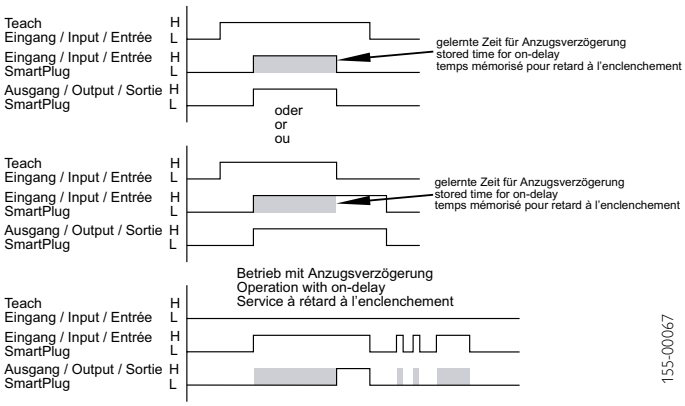
If, for example, a delay of four seconds should occur, the setting can be carried out as follows (operating voltage is switched on):

1. Connect Teach Input with $+U_B$
2. Actuate sensor for a duration of 4 seconds
3. Separate Teach Input from $+U_B$ ➜ FINISHED

After this adjustment, the SmartPlug has an on-delay of 4 s. The setting remains even when switched off.

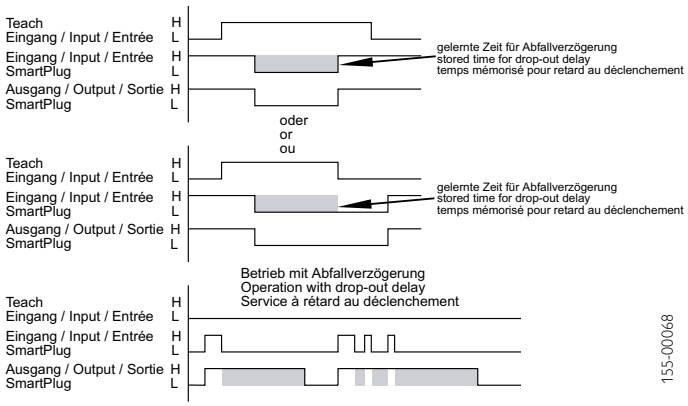
The timer is reset when the operating voltage is switched on. In the default state the preselected time is set to 100 ms drop-out delay.

Teaching-in an on-delay



155-00067

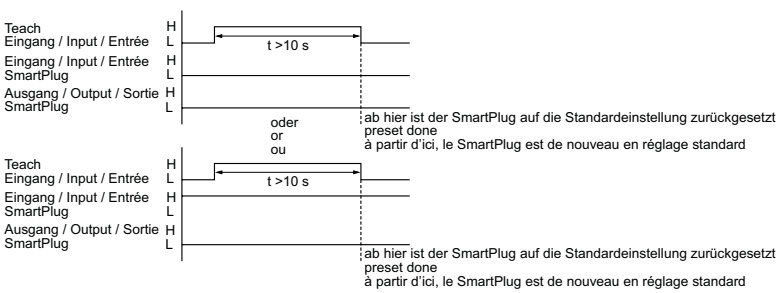
Teaching-in a drop-out delay



155-00068

H = input or output active; L = input or output inactive

Resetting to standard setting of 100 ms drop-out delay



155-00075

SmartPlug MFF

Programmable monitoring of frequency

CE

PRODUCT HIGHLIGHTS

- Direct adaptation between sensor and connection cable
- Monitoring of frequency of signals at "Input SmartPlug", e.g. for monitoring standstills, monitoring rotary speed and detecting accumulations
- Adjustable rotary speed or frequency limit via external teach-in
- No additional installations necessary
- Frequency range: 0.015 Hz … 1 kHz
- Switching amplifier up to 400 mA

Functions	
Indicator	LED, red
Adjustment possibilities	Monitoring standstills Monitoring rotary speed Detecting accumulations

Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC[1]
Power consumption	≤ 10 mA
Input resistance	> 10 kOhm
Input frequency	≤ 1 kHz
Input pulse width	50 µs
Output current, Ie	≤ 400 mA
Protective circuits	Short-circuit protection
Protection Class	2[2]
Switching output	See Selection Table
Standard connection	1 Bn $+U_B$ 3 BU $-U_B$ 4 BK output

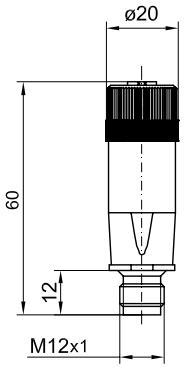
Mechanical data	
Dimensions	Ø 20 x 60 mm
Enclosure rating	IP 67[3]
Material, housing	Plastic PBTP / PA
Type of connection: input	M12 x1 socket, 4-pin
Type of connection: output	M12 x1 plug, 4-pin
Ambient temperature: operation	0 … +60 °C
Ambient temperature: storage	-20 … +60 °C
Weight	15 g

[1] 10 % ripple, within U_B [2] Only when connected on both sides [3] With connected IP 67 plug

Switching output	Part number	Article number
PNP	MFF 12 PP4	968-51000
NPN	MFF 12 NN4	968-51001

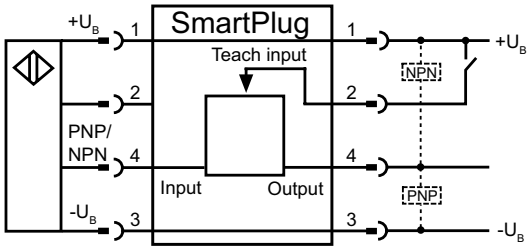
Accessories		
Description	**Part number**	**Article number**
Interface converter for configuration via PC	CUSB-IR-2m	901-05098
Connection adapter M8 (socket) to M12 (plug)	L4F/K4M - 0,6 PVC	902-51645

Plug connection



153-00255

Connection, 4-pin

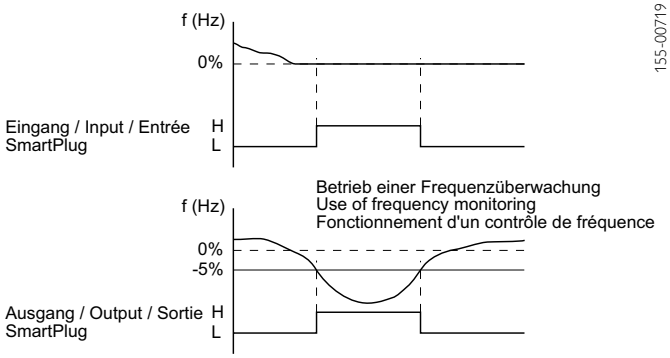


154-00239

Settings

1. Adjust the sensor with its SmartPlug MFF12 on the target object so that the sensor reliably switches.
2. Set the object in the motion to be monitored (e.g. motor set to nominal speed).
3. Connect Teach Input with +UB and separate again.
   (Lay down U_B pulse at Teach Input. Pulse must be at least as long as a complete movement cycle of the object.)
4. Finished: the SmartPlug output will be activated when the input frequency falls by more than 5%.

Teaching-in frequency monitoring



155-00719

SmartPlug MFW

Programmable timer for wipe function

PRODUCT HIGHLIGHTS

- Direct adaptation between sensor and connection cable
- Teachable as switch-on or switch-off wipe function
- Simple setting via external teach-in
- No additional installations necessary
- Time range: 1 … 65535 ms
- Switching amplifier up to 400 mA

Functions	
Indicator	LED, red
Adjustment possibilities	Positive rise / negative drop-out
Default setting	100 ms drop-out delay

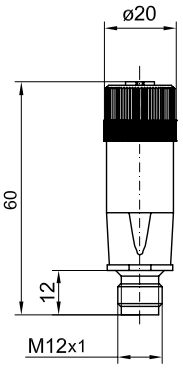
Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC[1]
Power consumption	≤ 10 mA
Input resistance	> 10 kOhm
Input frequency	≤ 10 kHz
Input pulse width	50 µs
Output current, Ie	≤ 400 mA
Protective circuits	Short-circuit protection
Protection Class	2[2]
Switching output	See Selection Table
Standard connection	1 Bn $+U_B$ 3 BU $-U_B$ 4 BK output

Mechanical data	
Dimensions	Ø 20 x 60 mm
Enclosure rating	IP 67[3]
Material, housing	Plastic PBTP / PA
Type of connection: input	M12 x1 socket, 4-pin
Type of connection: output	M12 x1 plug, 4-pin
Ambient temperature: operation	0 … +60 °C
Ambient temperature: storage	-20 … +60 °C
Weight	15 g

[1] 10 % ripple, within U_B [2] Only when connected on both sides [3] With connected IP 67 plug [4] Please define option with your order
[5] Presetting freely selectable between 1 … 65535 ms

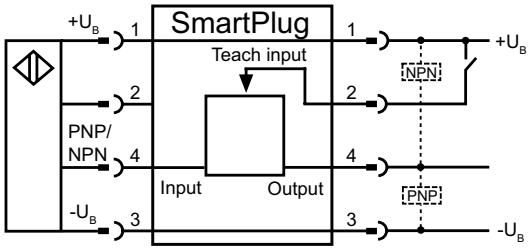
Switching output	Drop-out delay	Part number	Article number
PNP	100 ms	MFW 12 PP4	968-11008
NPN	100 ms	MFW 12 NN4	968-11009
PNP	1 … 65535 ms[4,5]	MFW 12 PP4 t:..	968-11010
NPN	1 … 65535 ms[4,5]	MFW 12 NN4 t:..	968-11011

Plug connection



153-00255

Connection, 4-pin



154-00239

Settings

Setting of the delay time is achieved via the "Teach Input" and "Input SmartPlug" signals.

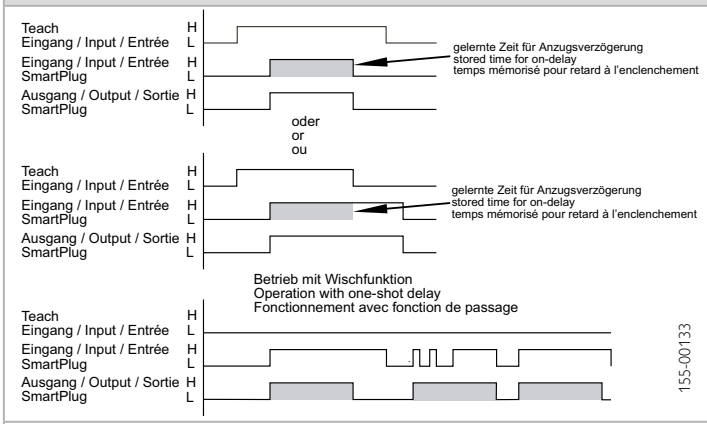
If, for example, there should be a delay of 4 seconds, the setting can be carried out as follows (operating voltage is switched on):

1. Connect Teach Input with $+U_B$
2. Actuate sensor for 4 seconds
3. Separate Teach Input from $+U_B$ ➜ FINISHED

After this setting, the SmartPlug has an on-delay of 4 seconds. The setting remains even when switched off.

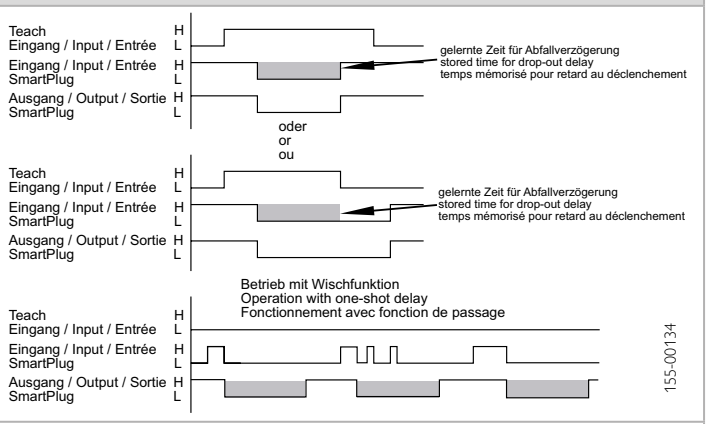
The timer is reset when operating voltage switched on. The default preselected time is set to 100 ms drop-out delay.

Teaching-in an on-delay



155-00133

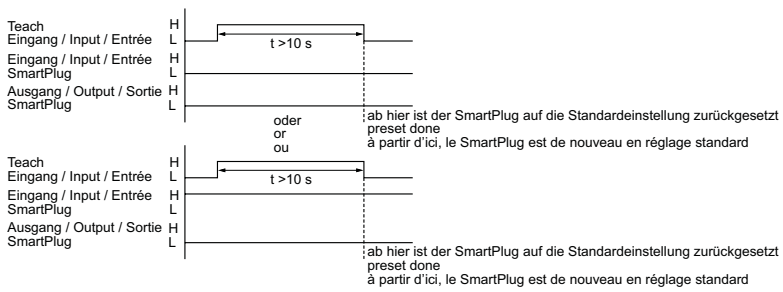
Teaching-in a drop-out delay



155-00134

H = input or output active; L = input or output inactive

Resetting to standard setting of 100 ms drop-out delay



155-00075

SmartPlug MFU

Multifunctional switching device

CE

PRODUCT HIGHLIGHTS

- Direct adaptation between sensor and connection cable
- Configurable via PC with USB interface
- No additional installations necessary
- PNP / NPN converter
- Counter for pulses and intervals
- Frequency monitoring
- Timer
- Switching amplifier up to 400 mA

Functions	
Indicator	LED, red
Adjustment possibilities	Time: 1 … 65535 ms Pre-set time: 1 … 65535 pulses Fequency: 15 Hz … 1 kHz

Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC[1]
Power consumption	≤ 10 mA
Input resistance	> 10 kOhm
Input frequency	≤ 8 kHz
Input pulse width	50 µs
Output current, Ie	≤ 400 mA
Protective circuits	Short-circuit protection
Protection Class	2[2]
Switching output	See Selection Table
Standard connection	1 Bn $+U_B$ 3 BU $-U_B$ 4 BK output

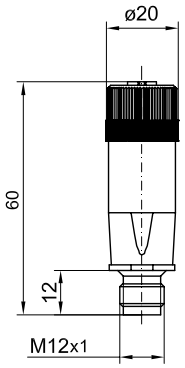
Mechanical data	
Dimensions	Ø 20 x 60 mm
Enclosure rating	IP 67[3]
Material, housing	Plastic PBTP / PA
Type of connection: input	M12 x1 socket, 4-pin
Type of connection: output	M12 x1 plug, 4-pin
Ambient temperature: operation	0 … +60 °C
Ambient temperature: storage	-20 … +60 °C
Weight	15 g

[1] 10 % ripple, within U_B [2] Only when connected on both sides [3] With connected IP 67 plug

Switching output	Part number	Article number
PNP	MFU 12 P4	968-61000
NPN	MFU 12 N4	968-61001

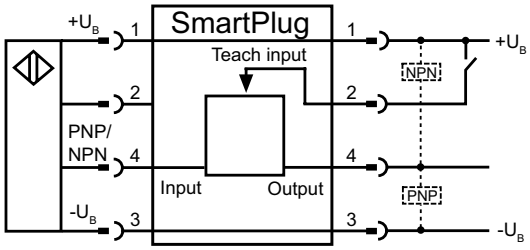
Accessories		
Description	**Part number**	**Article number**
Interface converter for configuration via PC (USB to IR)	CUSB-IR-2m	901-05098
Programmer adapter (RS232 to IR)	IR-RS232	901-05096
Connection adapter: M8 (socket) to M12 (plug)	L4F/K4M - 0,6 PVC	902-51645

Plug connection



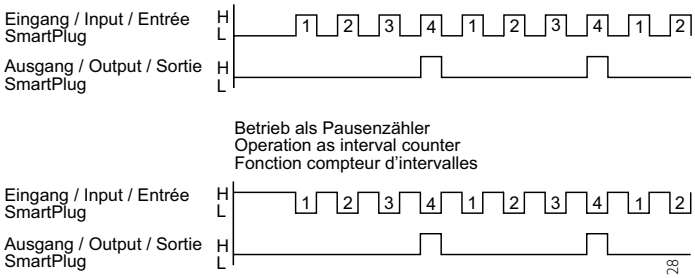
153-00255

Connection, 4-pin



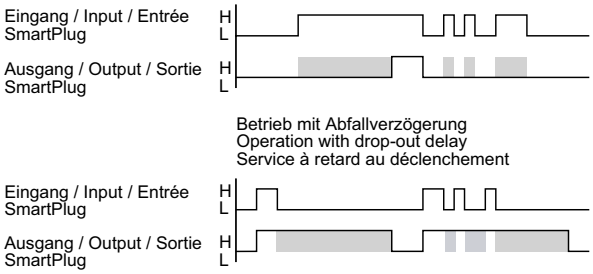
154-00239

Operation as pulse counter



155-00128

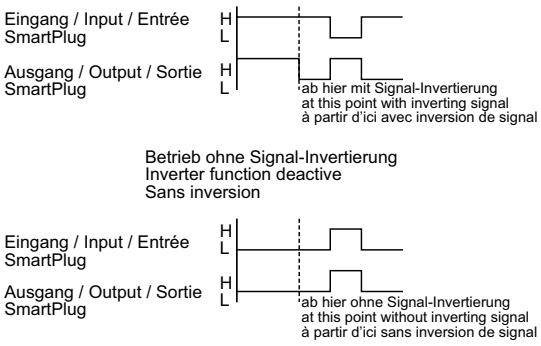
Operation as drop-out delay



155-00129

H = input or output active; L = input or output inactive

Operation with signal inversion



155-00130

Parameterisation via IR interface and "ProgSensor" configuration software

155-00762

Accessories

Connection cables	From Page A-38