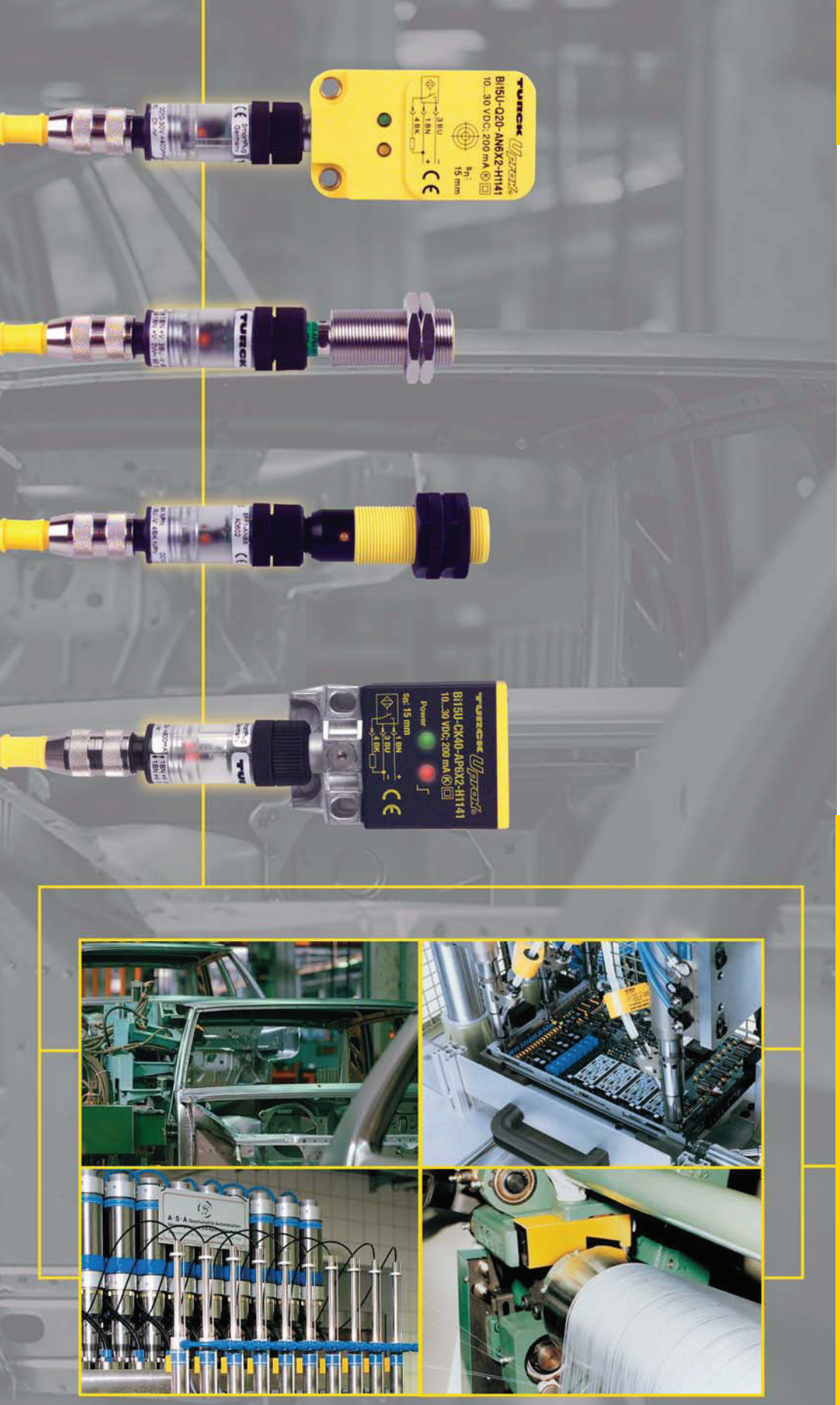
TURCK

Industrial
Automation

smart plug

ADD "SMARTS" TO YOUR SENSOR



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smartplug

Add "Smarts" to Your Sensor

smartplug makes your sensor or switch "Smart" by adding functionality to your signal output via a simple, teachable ***Plug and Work*** solution. Add functions such as timing, counting, speed monitoring or signal inversion by simply plugging the ***smartplug*** into your sensor or switch.

Programming is done via a simple "teach" input on the existing pin #2 of your existing M12 (***eurofast***®) connector. The ***SmartPlug*** works with not only **TURCK** sensors, but with 3-wire DC sensors from many different manufacturers. For connection to sensors using M8 (***picofast***®), or 7/8-16UN (***minifast***®) connectors, adaptor cables are available.

smartplugs may be combined in series to provide multiple functions, such as a speed monitor with a time delay.

smartplug **Features:**

- **Add function to existing installations.**
- **Solve control problems quickly in the field.**
- **Simple plug-in installation – uses industry standard M12 (*eurofast*) 4-pin connectors.**
- **Programmed through "teach" input – Pin 2. LED aids programming.**
- **All styles are 400 mA short-circuit-proof, noise immune switching amplifiers.**

Table of Contents

SPC1-AP6X / SPC1-AN6X

Programmable pulse or interval counter

- **Direct adaptation between sensor and connecting cable**
- **Counting of pulses or intervals**
- **Simple setting by external teach-input**
- **No additional wiring required**
- **Counting range from 0 to 65535**
- **Switching amplifier up to 400 mA**
- **N.C./N.O. inverter**

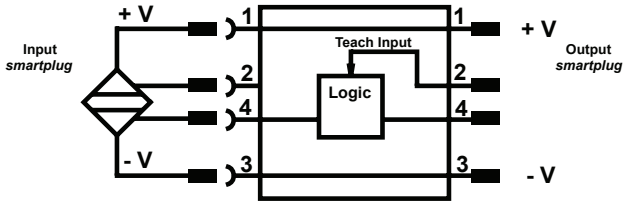
The SPC1 ***smartplug*** is a freely programmable counter for the direct adaptation to sensors with a standardized M12 (***eurofast***) connection.

The SPC1 ***smartplug*** is available in 2 versions:

PNP input - PNP output SPC1-AP6X (for use with PNP sensors)
NPN input - NPN output SPC1-AN6X (for use with NPN sensors)

Connection:

The ***smartplug*** is very easy to connect; it is plugged onto the M12 connector of a sensor and the connecting cable is connected to the other side of the ***smartplug***. The sensor configuration has to meet the standards (1+V (BN) 3 -V (BU) v4 output (BK)).



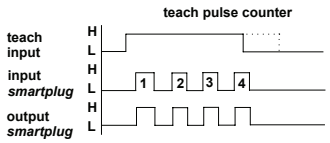
Setting:

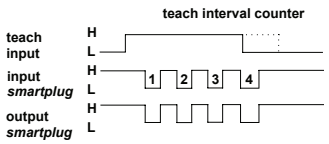
The setting of the preset number is made by using the signals "teach input" and "input ***smartplug***". If for example, 4 pulses have to be counted, the setting can be made as follows (operating voltage being switched on):

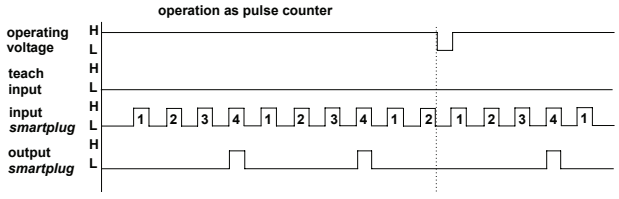
1. Connect teach input with +V.
2. Actuate the sensor 4 times (= 4 pulses) - The ***smartplug*** recognizes automatically 4 pulses at the "input ***smartplug***".
3. Disconnect teach input from +V → READY.

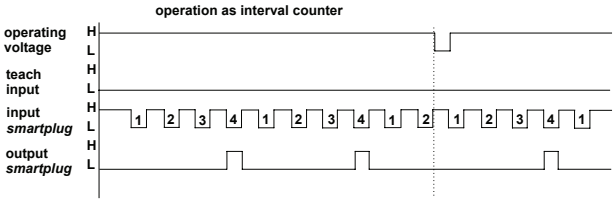
After this setting, the output of the ***smartplug*** is activated every fourth pulse. The setting is maintained when the sensor is switched off.

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







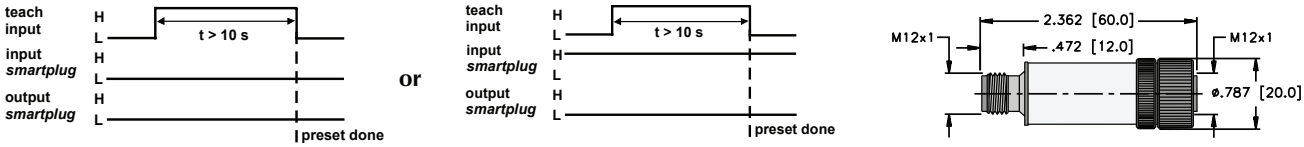


When switching on the operating voltage, the counting procedure is reset.
The initial state of the preset number is 1 (pulse counter).

Technical Data

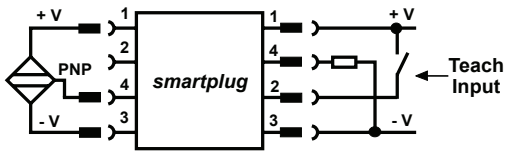
Operating Voltage	10-30 VDC, residual ripple of max. 10%	**Display:**	Red LED
Own Current Consumption:	<10 mA	**Housing Material:**	Plastic PBTP/PA
Input Resistance:	>10 kΩ	**Protection Standard:**	IP 67
Max. Input Frequency:	10 kHz	**Dimensions Inches[mm]:**	See diagram
Min. Response Time:	0.1 ms	**Connection Input:**	4-pin socket M12
Max. Output Current:	400 mA short-circuit proof	**Connection Output:**	4-pin connector M12
Ambient Temperature Range:	0° to +60°C (+32° to +140°F)	**Weight:**	15 g
Storage Temperature Range:	-20° to +60°C (-4° to +140°F)		

Preset to factory setting 1 pulse counter

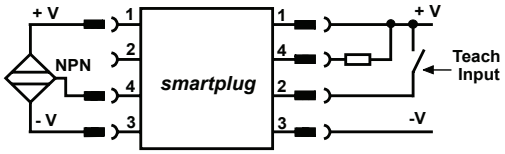


Wiring Diagrams

SPC1-AP6X



SPC1-AN6X



Application Examples:

1. Gearwheel/Divider: On a gearwheel with 100 teeth, one pulse per rotation is to be measured.

   a) A suitable sensor with standardized M12x1 connection is mounted in a way that each tooth is safely recognized.
   b) A ***smartplug*** SPC1 is connected between sensor and sensor connecting cable.
   c) The preset number 100 is taught into the ***smartplug***, → connect "teach input" with +V, turn round the gearwheel exactly one time.
   d) Disconnect "teach input" from +V. READY

   At the output of the ***smartplug***, one pulse per rotation is measured.

2. Counting parts: Bulk material is filled into cartons by means of a conveyor belt. The task is to specify the exact number of parts required to fill up the carton.

   a) A suitable sensor with standardized M12x1 connection is mounted in a way that all parts are safely recognized.
   b) A ***smartplug*** SPC1 is connected between sensor and sensor connecting cable.
   c) A "teach input" stays connected to +V until the desired number of parts has passed the sensor (=unit the carton is full).
   d) Disconnect "teach input" from +V. READY

   At the output of the ***smartplug***, one pulse is measured when the preset quantity of parts has been recorded; the carton is full.

3. Switching amplifier: Most sensors have a maximum output current of 100 mA to 200 mA. By using a ***smartplug***, the maximum output current can be increased to 400 mA.

   a) A ***smartplug*** SPC1 is connected between sensor and sensor connecting cable.
   b) The "teach input" stays connected to +V until the sensor has been actuated once (preset number 1).
   c) Disconnect "teach input" from +V. READY

   At the output of the ***smartplug*** every input pulse is measured, the output can be charged with 400 mA.

4. N.C./N.O. inverter: Teach the ***smartplug*** as interval counter "1". An input N.C. signal will be inverted into a N.O. signal and reverse.

SPF1-AP6X / SPF1-AN6X

Programmable over or under speed monitor

- **Direct adaptation between sensor and connecting cable**
- **Teachable speed limit**
- **Simple setting by external teach-input**
- **No additional wiring required**
- **Frequency range 0.015 Hz - 1 kHz**
- **Output load up to 400 mA**

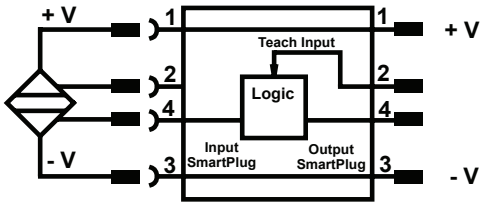
The SPF1 ***smartplug*** is a frequency threshold module for the direct adaptation to sensors with a standard M12 (***eurofast***) connection.

The SPF1 ***smartplug*** is available in 2 versions:

PNP input - PNP output SPF1-AP6X (for use with PNP sensors)
NPN input - NPN output SPF1-AN6X (for use with NPN sensors)

Connection:

The ***smartplug*** is very easy to connect; it is plugged onto the M12 connector of a sensor and the connecting cable is connected to the other side of the ***smartplug***. The sensor configuration has to meet the standards (1 +V (BN) 3 -V (BU) 4 output (BK)).



Function:

The ***smartplug*** SPF1 observes the frequency of the signal at the pin "input ***smartplug***". The output is activated if the setup frequency falls below approximately 5%.

Setting for under speed monitoring:

1. Set sensor up to sense object with ***smartplug*** SPF1 connected. Make sure sensor is sensing properly and output is switching.
2. Move object or set rotation to nominal speed.
3. Connect +voltage +V to "Teach Input" and then disconnect (turn off) voltage +V. (Pulse +V to Teach Input, >1 full cycle of senses object - e.g. >1 full revolution)
4. Done, if speed or frequency drops by 5% or 95% of nominal speed, then ***smartplug*** is activated.

Setting for over speed monitoring:

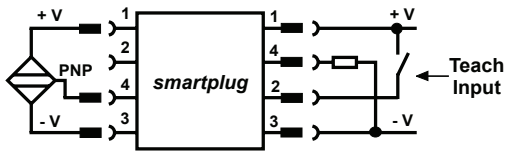
(Note: over speed output will be inverted. i.e. output activated for normal speed & output off for over speed.)

1. Set sensor up to sense object with ***smartplug*** SPF1 connected. Make sure sensor is sensing properly and output is switching.
2. Move object to set rotation to 106% plus X% over speed allowance of nominal speed.
3. Connect+voltage +V to "Teach Input" and then disconnect (turn off) voltage +V. (Pulse+V to Teach Input, >1 full cycle of senses object - e.g. >1 full revolution).
4. Done. If speed or frequency goes above setpoint, then ***smartplug*** output goes off.

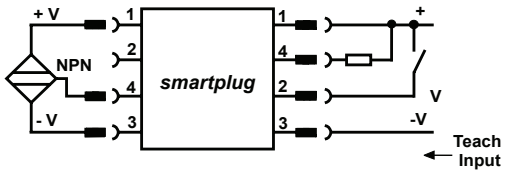
Technical Data

Operating Voltage:	10-30 VDC, residual ripple of max. 10%	**Display:**	Red LED
Own Current Consumption:	<10 mA	**Housing Material:**	Plastic PBTP/PA
Input Resistance:	>10 kΩ	**Protection Standard:**	IP 67
Max. Input Frequency:	10 kHz	**Dimensions Inches[mm]:**	See diagram
Min. Response Time:	0.1 ms	**Connection Input:**	4-pin socket M12
Max. Output Current:	400 mA short-circuit proof	**Connection Output:**	4-pin connector M12
Ambient Temperature Range:	0° to +60°C (+32° to +140°F)	**Weight:**	15 g
Storage Temperature Range:	-20° to +60°C (-4° to +140°F)		

SPF1-AP6X

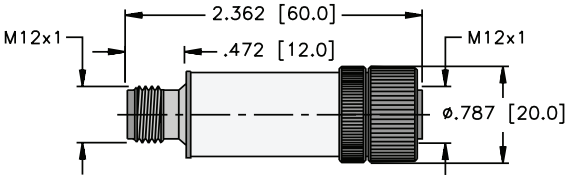


SPF1-AN6X



Applications Examples:

1. Jam detection
2. RPM Observation
3. Conveyor built back detection
4. Cooling fan motion control



Programming:

1. Connect the sensor to the ***smartplug*** and connect the ***smartplug*** to the power supply and load.
2. You will notice that no LEDs are on and the load is not switched.
3. Bring a target to the sensor to energize the sensor output.
4. The sensor will energize and the red LED in the ***smartplug*** will energize and turn on the load and both will remain energized.
5. For underspeed switching
   a. Calculate the underspeed trip point desired. Taking into consideration the critical time base reaction you need to protect your process.
   b. Divide the underspeed trip point by 0.95. This is your nominal speed.
   c. Rotate your target or targets to the nominal speed.
   d. Connect the teach wire (usually the white wire) to plus + voltage on your power supply for one full rotation of your target or targets then disconnect the teach wire.
   e. Your ***smartplug*** is now taught. As long as your pulses to the ***smartplug*** remain above your nominal speed X 0.95 your output will be off. As soon as the speed drops 0.95 X nominal or below the unit will energize the output and the LED on the ***smartplug*** will turn on.
6. For overspeed switching
   a. Calculate the overspeed trip point desired. Taking into consideration the critical time base reaction you need to protect your process.
   b. Divide the overspeed trip point by 1.06. This is your nominal speed.
   c. Rotate your target or targets to the calculated overspeed.
   d. Connect the teach wire (usually the white wire) to plus + voltage on your power supply for one full rotation of your target or targets then disconnect the teach wire.
   e. Your ***smartplug*** is now taught. As long as your pulses to the ***smartplug*** remain at or below your nominal speed X 1.06 your output will be on and the LED on the ***smartplug*** will be on. As soon as the speed reaches 1.06 X nominal or above, the output and the LED on the ***smartplug*** will turn off.

SPN1-AP6-ARN6X / SPN1-AN6-ARP6X

PNP/NPN or NPN/PNP converter, adjustable N.O./N.C. inverter

- **Direct adaptation between sensor and connecting cable**
- **N.C./N.O. function adjustable**
- **Simple setting via external teach-input**
- **No additional wiring required**
- **Switching frequency up to 10 kHz**
- **Switching amplifier up to 400 mA**

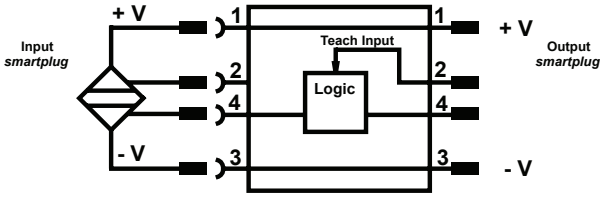
The SPN1 ***smartplug*** is a switching channel convertor for the direct adaptation to sensors with a standard M12 (***eurofast***) connection.

The SPN1 ***smartplug*** is available in 2 versions:

PNP input - NPN output SPN1-AP6-ARN6X (for the conversion of PNP sensors to NPN output)
NPN input - NPN output SPN1-AN6-ARP6X (for the conversion of NPN sensors to PNP output)

Connection:

The ***smartplug*** is very easy to connect: it is plugged onto the M12x1 connector of a sensor and the connecting cable is connected to the other side of the ***smartplug***. The sensor configuration has to meet the standards (1 +V (BN) 3 -V (BU) 4 output (BK)).



Function:

The ***smartplug*** SPN1-AP6-ARN6X converts a PNP input signal into a NPN output signal.
The ***smartplug*** SPN1-AN6-ARP6X converts a NPN input signal into a PNP output signal.
Additionally the signal can be inverted (N.C./N.O. function).

Setting:

The setting of the inverting function is made by means of the signals "teach input" and "input ***smartplug***"

Example:

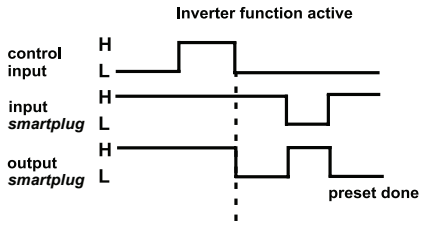
1. Setting the ***smartplug*** into the inverting mode:
   a) activate sensor (output is on)
   b) connect teach input and +V and disconnect (pulse or signal to +V). READY
2. Setting the ***smartplug*** into the non-inverting mode (factory setting)
   a) inactivate sensor (output is off)
   b) connect teach input and +V and disconnect (pulse or signal to +V). READY

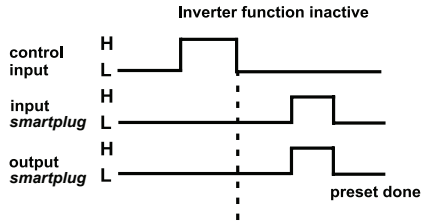
This setting is maintained when the sensor is off.

Technical Data

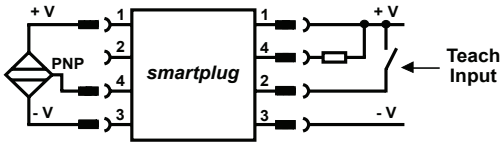
Operating Voltage:	10-30 VDC, residual ripple of max. 10%	**Display:**	Red LED
Own Current Consumption:	<10 mA	**Housing Material:**	Plastic PBTP/PA
Input Resistance:	>10 kΩ	**Protection Standard:**	IP 67
Max. Input Frequency:	10 kHz	**Dimensions Inches[mm]:**	See diagram
Min. Response Time:	0.1 ms	**Connection Input:**	4-pin socket M12
Max. Output Current:	400 mA short-circuit proof	**Connection Output:**	4-pin connector M12
Ambient Temperature Range:	0° to +60°C (+32° to +140°F)	**Weight:**	15 g
Storage Temperature Range:	-20° to +60°C (-4° to +140°F)		

H= input/output active
L= input/output inactive

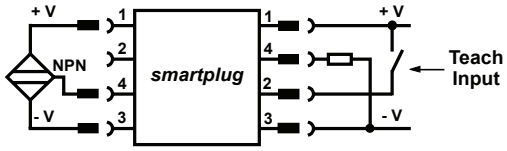


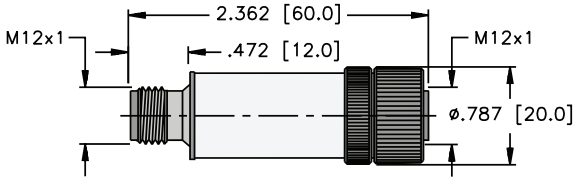


SPN1-AP6-ARN6X



SPN1-AN6-ARP6X





Function	SmartPlug	Setting
PNP / NPN converter	SPN1-AP6-ARN6X	Factory setting
NPN / PNP converter	SPN1-AN6-ARP6X	Factory setting
PNP / NPN converter and N.C. / N.O. inverter	SPN1-AP6-ARN6X	Setup: N.O. → N.C.
NPN/ PNP converter and N.C. / N.O inverter	SPN1-AN6-ARP6X	Setup: N.O. → N.C.

SPT1-AP6X / SPT1-AN6X

Programmable timer for on-delay time or off-delay time

- **Direct adaptation between sensor and connecting cable**
- **Teachable as on-delay time or off-delay time**
- **Simple setting by external teach-input**
- **No additional wiring required**
- **Time range between 1 and 65535 ms**
- **Switching amplifier up to 400 mA**
- **Can be used as pulse stretcher**

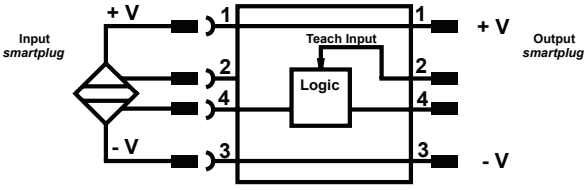
The SPT1 ***smartplug*** is a freely programmable timer for the direct adaptation to sensors with a standardized M12x1 connection.

The SPT1 ***smartplug*** is available in 2 versions:

PNP input - PNP output SPT1-AP6X (for use with PNP sensors)
NPN input - NPN output SPT1-AN6X (for use with NPN sensors)

Connection:

The ***smartplug*** is very easy to connect: it is plugged onto the M12 (***eurofast***) connector of a sensor and the connecting cable is connected to the other side of the ***smartplug***. The sensor configuration has to meet the standards (1 +V (BN) 3 -V (BU) 4 output (BK)).



Programming:

On Delay (Rise Delay)

Step 1 - Activate white programming wire and hold.
Step 2 - Activate sensor for time delay desired.
Step 3 - Deactivate sensor after time delay desired.
Step 4 - Deactivate white programming wire.

Off Delay (Fall Delay)

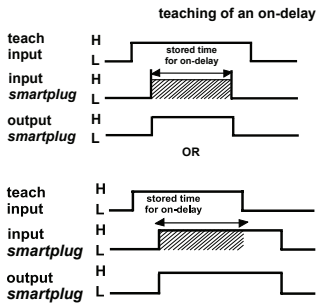
Step 1 - Activate sensor.
Step 2 - Activate white programming wire and hold.
Step 3 - Deactivate sensor after time delay desired.
Step 4 - Reactivate the sensor after time delay desired.
Step 5 - Deactivate white programming wire.

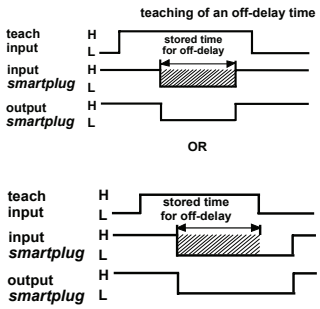
Setting:

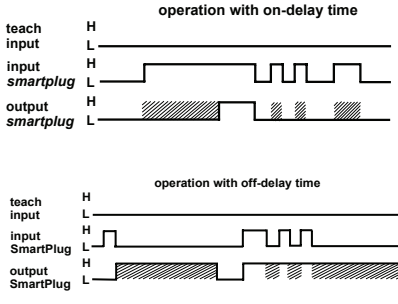
The setting of the delay time is made by means of the signals "Teach input" and "Input ***smartplug***". A delay time of 4 seconds for example can be set as follows (the operating voltage being switched on):

1. Connect teach input with +V
2. Actuate sensor for 4 seconds
3. Disconnect teach input from +V. READY

After this setting the ***smartplug*** has a slow operation lasting 4 seconds. This setting is maintained when the sensor is switched off.





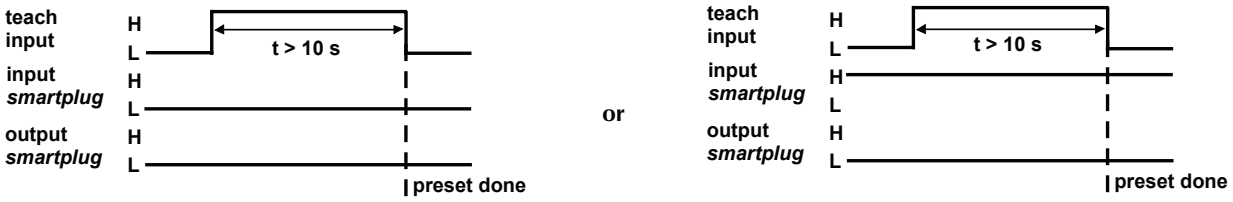


When switching on the operating voltage, the timer is reset. The initial state of the preset time is 100 ms off-delay.
H= input/output active L= input/output inactive

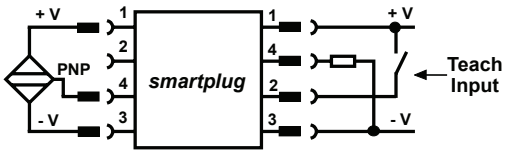
Technical Data

Operating Voltage:	10-30 VDC, residual ripple of max. 10%	**Display:**	Red LED
Own Current Consumption:	<10 mA	**Housing Material:**	Plastic PBTP/PA
Input Resistance:	>10 kΩ	**Protection Standard:**	IP 67
Max. Input Frequency:	10 kHz	**Dimensions Inches[mm]:**	See diagram
Min. Response Time:	0.1 ms	**Connection Input:**	4-pin socket M12
Max. Output Current:	400 mA short-circuit proof	**Connection Output:**	4-pin connector M12
Ambient Temperature Range:	0° to +60°C (+32° to +140°F)	**Weight:**	15 g
Storage Temperature Range:	-20° to +60°C (-4° to +140°F)		

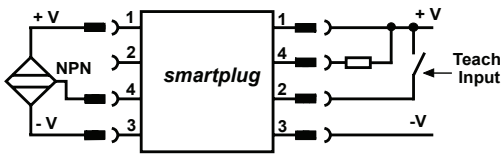
To preset to factory setting 100 ms off-delay

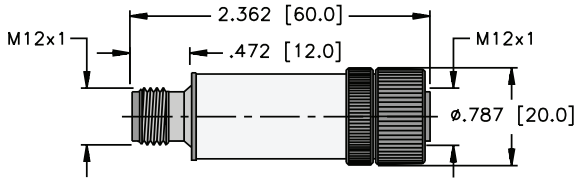


SPT1-AP6X



SPT1-AN6X

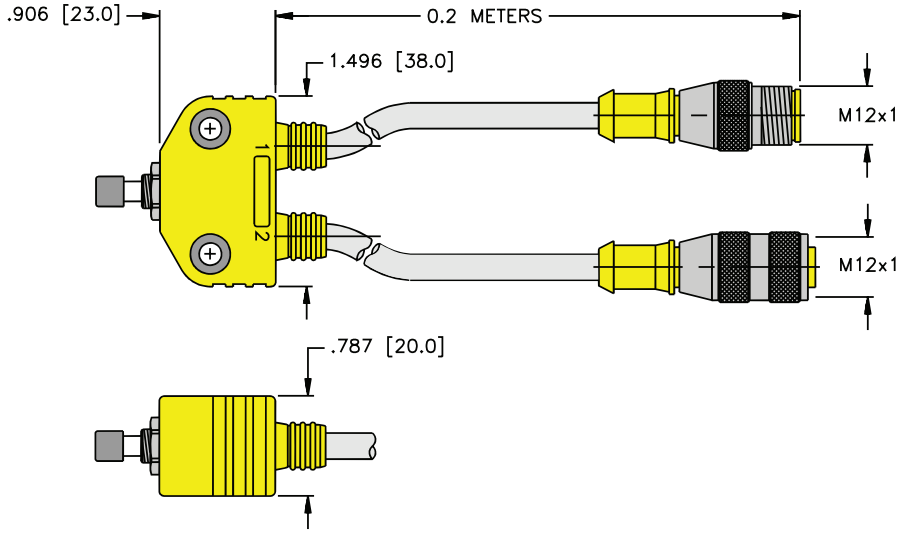




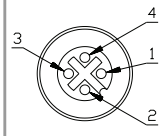
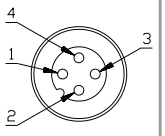
SmartPlug Programing Push Button

VB2-SP1

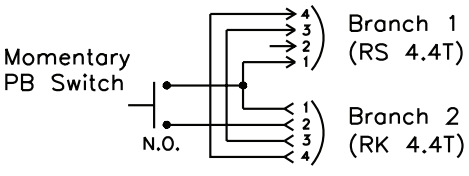
Dimensions



Pinouts

Female	Male
	
4-pin	4-pin

Wiring Diagram



Notes:

TURCK sells its products through Authorized Distributors. These distributors provide our customers with technical support, service and local stock. **TURCK** distributors are located nationwide - including all major metropolitan marketing areas.

For Application Assistance or for the location of your nearest **TURCK** distributor, call:

1-800-544-PROX (1-800-544-7769)

Specifications in this manual are subject to change without notice. **TURCK** also reserves the right to make modifications and makes no guarantee of the accuracy of the information contained herein.

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