GB

Operating instructions
Compact speed monitor M18
DI605A

11473500 / 00 07 / 2022

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1 Preliminary note

You will find instructions, technical data, approvals and further information using the QR code on the unit / packaging or at www.ifm.com.

1.1 Symbols used

✓	Requirement
▶	Instructions
▷	Reaction, result
[...]	Designation of keys, buttons or indications
→	Cross-reference
	Important note Non-compliance may result in malfunction or interference.
	Information Supplementary note

2 Safety instructions

- The unit described is a subcomponent for integration into a system.
  - The system architect is responsible for the safety of the system.
  - The system architect undertakes to perform a risk assessment and to create documentation in accordance with legal and normative requirements to be provided to the operator and user of the system. This documentation must contain all necessary information and safety instructions for the operator, the user and, if applicable, for any service personnel authorised by the architect of the system.
- Read this document before setting up the product and keep it during the entire service life.
- The product must be suitable for the corresponding applications and environmental conditions without any restrictions.
- Only use the product for its intended purpose (→ Intended use).
- If the operating instructions or the technical data are not adhered to, personal injury and/or damage to property may occur.
- The manufacturer assumes no liability or warranty for any consequences caused by tampering with the product or incorrect use by the operator.
- Installation, electrical connection, set-up, operation and maintenance of the product must be carried out by qualified personnel authorised by the machine operator.
- Protect units and cables against damage.

2.1 Use in hazardous areas

Observe the instructions for safe use in hazardous areas:
operating instructions (Ex protection related part) for speed monitors according to EU directive 2014/34/EU annex VIII (ATEX) group II, equipment category 3D.

If no operating instructions (Ex protection related part) or EC declaration of conformity are supplied with this product in the language of the EU user country, these can be requested from your dealer (see delivery note) or manufacturer.

3 Intended use

The non-contact unit detects when a set rotational speed value is exceeded or not reached and signals this with a switched output.

The unit can be operated in IO-Link mode or in SIO mode (switching output). The pulse output enables external evaluation of the damping pulses in both operating modes.

In IO-Link mode, the measured value, jams and SSC bits can be read as cyclic process data and transferred to a controller, and parameters can be read and written acyclically for configuration, identification and diagnostics.

In the mode without IO-Link communication, the unit is in switching mode (SIO mode) with the previously configured switching function.

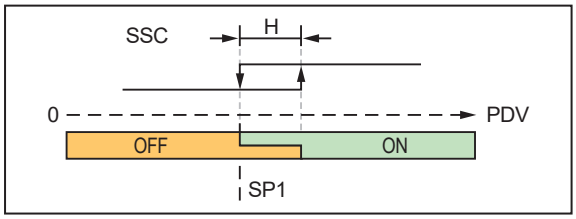
4 Function

The unit has two independently configurable switching channels.

About the measuring function:
The sensor measures the time between 2 successive transitions from “undamped” to “damped”. The pulse/pause ratio undamped/damped is not relevant, but both the damped and undamped states should be reliably detected.

If the frequency determined from this time [1/min] is below the last measured value, the output speed decreases with 1/t. At less than 0.5 pulses/min, 0.0 pulses/min is measured. There is no underload. An overload is present at over 32,000.0 pulses/min (533 Hz).

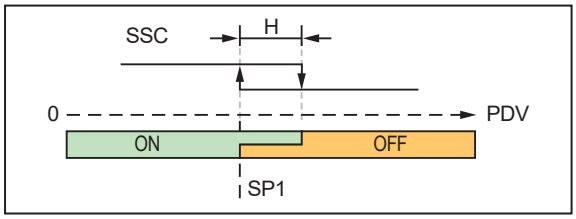
4.1 Single-point mode



SP1: Switch-off point
SP1+H: Switch-on point

Fig. 1: Normally open = low active (factory setting)

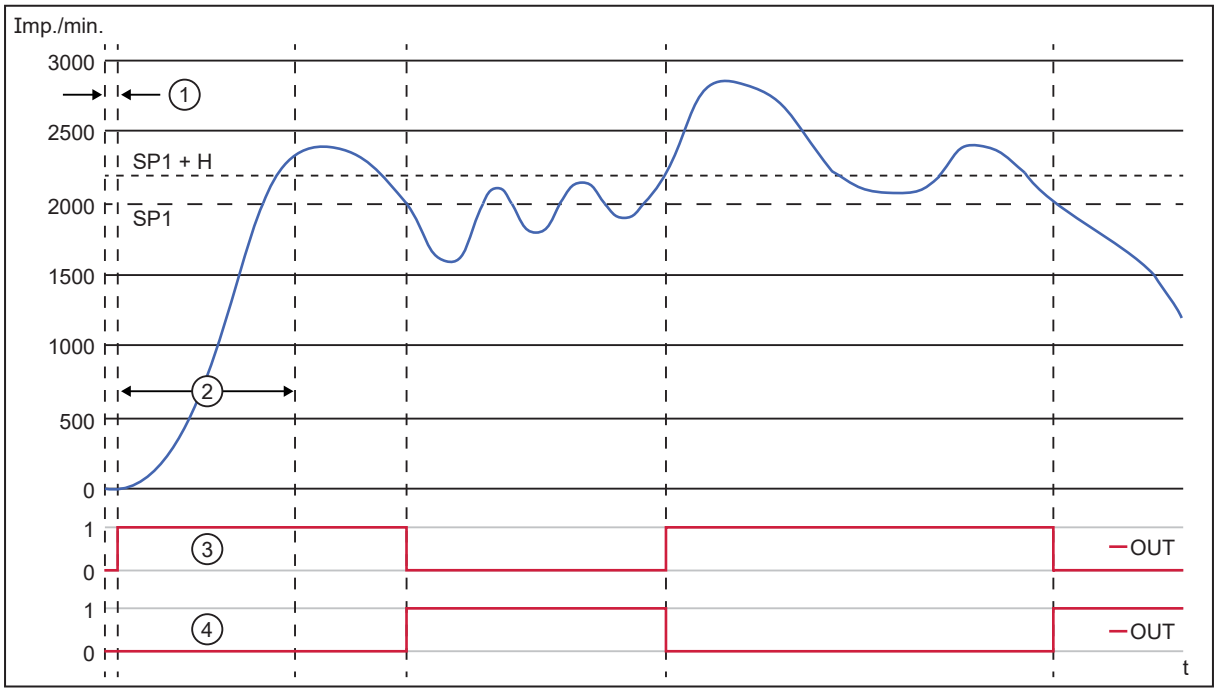
If a set rotational speed is not reached, the transistor output will signal this as non-conducting.



SP1: Switch-on point
SP1+H: Switch-off point

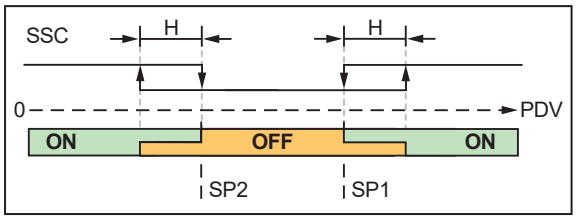
Fig. 2: Normally closed = high active

If a set rotational speed is not reached, the transistor output will signal this as conducting.



1: Power-on delay time
2: Start-up delay
3: Normally open = low active
4: Normally closed = high active

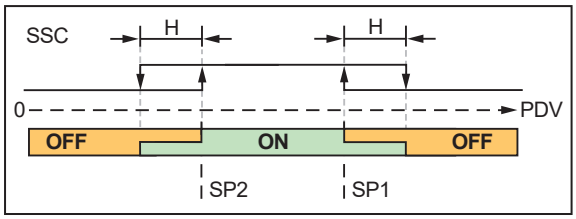
4.2 Window mode



SP2: Switch-off point
SP2-H: Switch-on point
SP1: Switch-off point
SP1+H: Switch-on point

Fig. 3: Normally open = low active

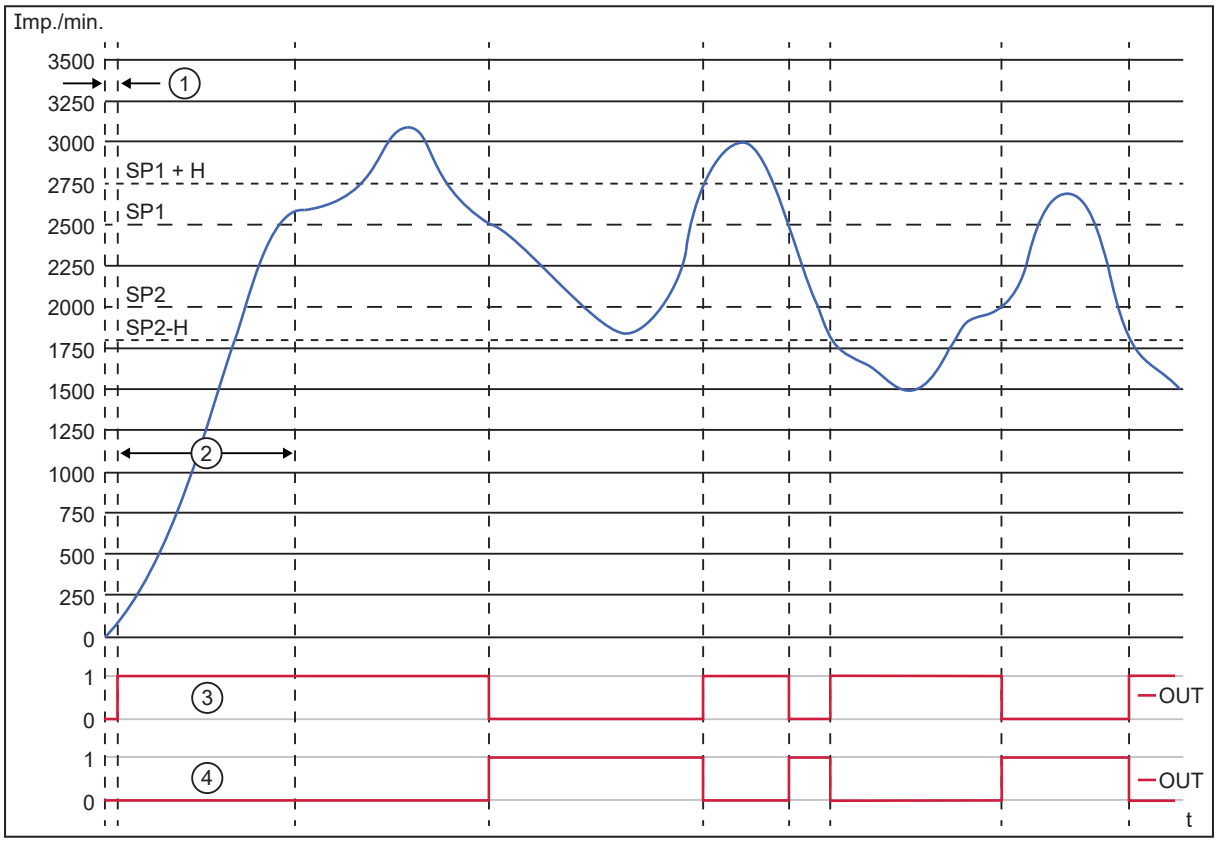
If the set speed range is left, the transistor output will signal this as non-conducting.



SP2: Switch-on point
SP2-H: Switch-off point
SP1: Switch-on point
SP1+H: Switch-off point

Fig. 4: Normally closed = high active

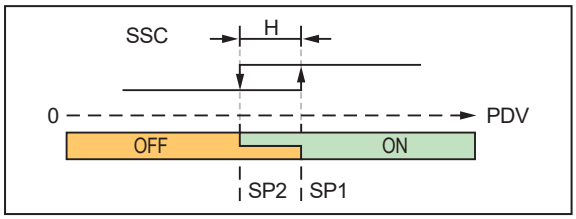
If the set speed range is left, the transistor output will signal this as conducting.



1: Power-on delay time
2: Start-up delay
3: Normally open = low active
4: Normally closed = high active

It is also possible to configure SP1 as the lower switch point and SP2 as the upper switch point. The lower switch point must be at least 10% lower than the higher switch point.

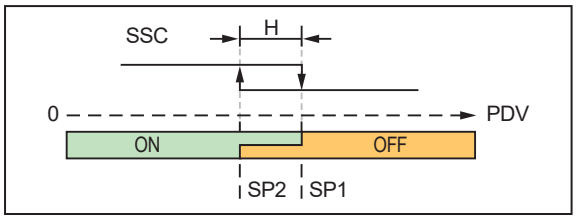
4.3 Two-point mode



SP2: Switch-off point
SP1: Switch-on point

Fig. 5: Normally open = low active

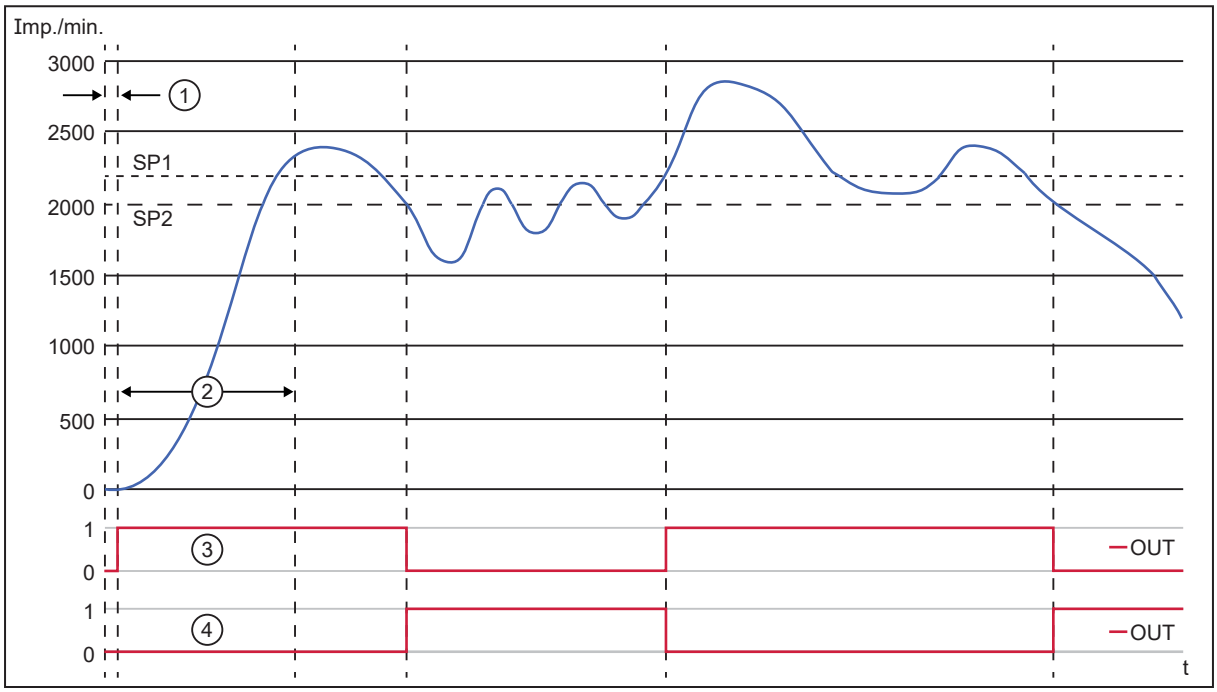
If a set rotational speed is not reached, the transistor output will signal this as non-conducting.



SP2: Switch-on point
SP1: Switch-off point

Fig. 6: Normally closed = high active

If a set rotational speed is not reached, the transistor output will signal this as conducting.



1: Power-on delay time
2: Start-up delay
3: Normally open = low active
4: Normally closed = high active

It is also possible to configure SP1 as the lower switch point and SP2 as the upper switch point. The lower switch point must be at least 10% lower than the higher switch point.

4.4 IO-Link mode

IO-Link allows the configuration of internal parameters such as switching threshold, start-up delay and switching behaviour (normally closed/normally open) as well as reading the current measured values. Furthermore IO-Link protects against signal faults and measured value losses as well as tampering with the sensor. IO-Link facilitates the identification of connected devices in the system and provides diagnostic functions.

4.4.1 General information

The unit has an IO-Link communication interface which requires an IO-Link capable module (IO-Link master).

The IO-Link interface allows direct access to the process and diagnostic data and enables setting of the parameters of the unit during operation.

You will find further information about IO-Link and all the necessary information about the required IO-Link hardware and software at:
www.io-link.ifm

4.4.2 IO Device Description (IODD)

You will find the IODDs required for configuration of the IO-Link device as well as detailed information about the process data structure, diagnostic information and parameter addresses at
documentation.ifm.com

4.5 SIO mode

The yellow LED indicates the switching status of the sensor.

4.5.1 Switching function normally open (low active)

Transistor output	LED yellow	State
Conducting (ON)	On	Rotational speed > SP + H and during start-up delay
Non-conducting (OFF)	Off	Rotational speed < SP

SP = switch point
H = hysteresis

4.5.2 Switching function normally closed (high active)

Transistor output	LED yellow	State
Non-conducting (OFF)	Off	Rotational speed > SP + H and during start-up delay
Conducting (ON)	On	Rotational speed < SP

SP = switch point
H = hysteresis

4.6 Start-up delay

The start-up delay ignores the underspeed signal in the start-up phase. After application of the operating voltage the start-up delay is effective only once.

Linking the drive and speed monitor power supplies ensures that the start-up delay is effective each time the machine is switched on.

See: dSt (→ 🗋 16)

4.7 Teach offset

This parameter allows setting of an offset between the taught process value and the resulting switching value.

Example: teach offset = 80% / NO (low active)
If a teach process is carried out while a motor is running at a nominal rpm of 3,600 pulses/min, the switch point is set to 2,880 pulses/min (80% of the value recorded in teach). In the event of underspeed (< 2,880 pulses/min) the switching output is blocked.

See: Teach offset (→ 🗋 15)

4.8 Prescaler

The prescaler is a divider to calculate the actual rpm as process data value (PDV) in an application with several cams on an axis.

The measurement limit is reduced by this divider.

Recommendation: Set the prescaler to the number of cams for one revolution. This makes it possible to determine the actual rpm.

See: PrSC (→ 🗋 15)

5 Installation

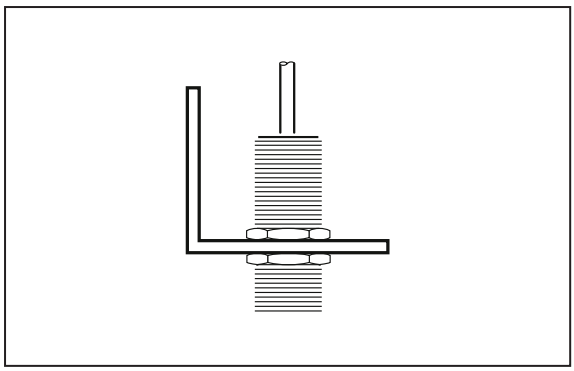


Fig. 7: Mounting principle

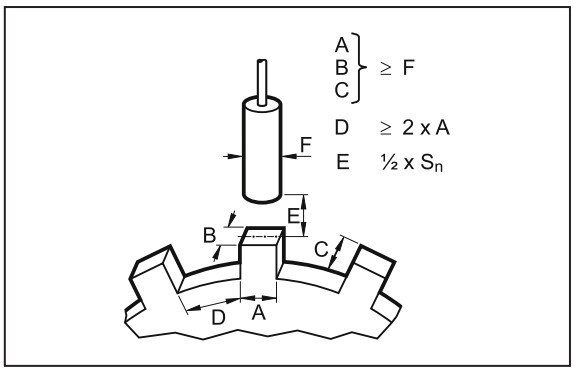


Fig. 8: Mounting specifications

- ▶ Fix the unit using a bracket and secure it by means of the nuts provided so that it cannot work loose.
- ▶ Adhere to the above mounting specifications to ensure a correct function.
- ▶ Install the unit flush.

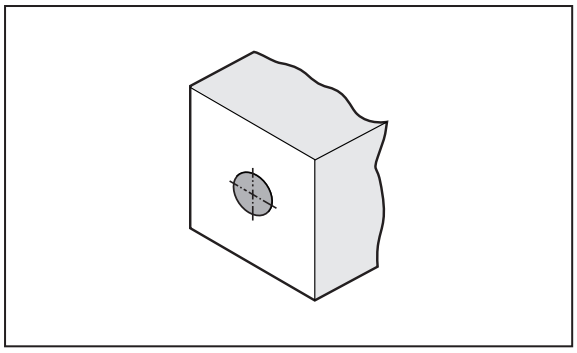


Fig. 9: Cylindrical design, flush

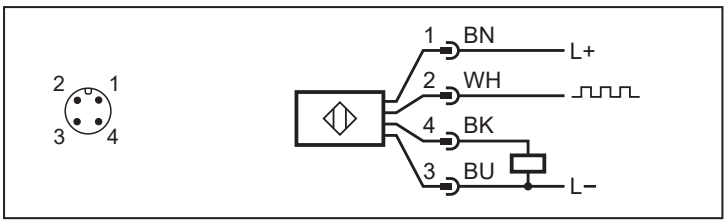
6 Electrical connection

The unit must be connected by a qualified electrician.

▶ Observe the national and international regulations for the installation of electrical equipment.

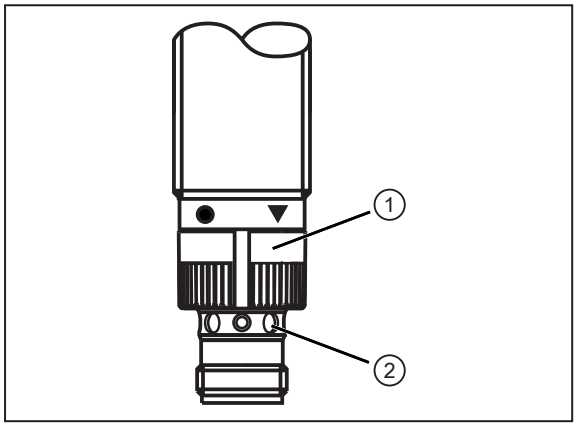
▶ Disconnect power.

▶ Connect the unit as follows:



1: L+
2: Pulse output (the pulse sequence corresponds to the damping frequency)
3: L-
4: Switching output (adjustable) / IO-Link communication
Factory setting: PNP / normally open

7 Operating and display elements



1: Push ring
2: LEDs yellow/green/red

7.1 Push ring (pushbuttons)

▶ To execute a [●] or [▼] command, turn the push ring to the corresponding symbol.

Button		Function
[●]	Enter	Open menu mode: Parameter setting via the unit keys (→ 🗋 17). Selection of the parameter and acknowledgement of a parameter value.
[▼]	Down	Selection of a parameter. Setting of a parameter value.

7.2 LED

LED colour	Status	Designation
Yellow	On	Switching output conducting (operating mode)
	Off	Switching output non-conducting (operating mode)
	Flashing	See Parameter setting mode (→ 🗋 17)
	Double flash	Parameters saved (parameter setting mode)
Green	On	Unit damped (installation/set-up mode)
	Off	Unit not damped (installation/set-up mode)
	Flashing	- different flashing frequencies: Parameter setting mode (→ 🗋 17) - damping frequency up to max. 8 Hz (installation/set-up mode) - visual localisation of the unit, 1 Hz (IO-Link system command)
Yellow/green	Flashing	Unit locking
Red	On	Device hardware fault
	Off	No error
	Flashing	Warning: - speed exceeds maximum damping frequency - unit outside the operating temperature - teach not possible: Parameter setting mode (→ 🗋 17) → Teach SP1

8 Parameter setting

Parameter setting can be carried out via the IO-Link interface or via the operating elements on the unit.

Parameters can be set before installation or during operation.

If you change parameters during operation, this will influence the function of the plant.

▶ Ensure that there will be no malfunctions in your plant.

During parameter setting the unit remains in the operating mode. It continues to monitor with the existing parameter until the parameter setting has been completed.

Depending on the parameter setting, the parameters available in the menu may change.

8.1 Parameter setting via the IO-Link interface

The following parameters can be checked/set via the IO-Link interface among others:

8.1.1 P-n

Output polarity for the switching outputs:

- PnP (factory setting)
- nPn

8.1.2 ou1

Output configuration for OUT1:

- OFF / output off
- SSC1.1 (factory setting)

8.1.3 ou2

Output configuration for OUT2:

- ImP / pulse output (factory setting)
- OFF / output off
- SSC1.2

When configured as a pulse output, the output switches according to the damped/undamped state of the sensor.

By combining ou1 and ou2, two switching functions can be implemented in one unit, e.g.:
- SSC1.1 as NO and SSC1.2 as NC with identical switch points → The two outputs switch complementary.
- With different switch points, different states can be monitored with only one sensor (e.g. “motor under load” and “motor blocked”).

8.1.4 SSC1.x Param. SP1

Switch point 1:

- 2.1...24,000 pulses/min; factory setting: 100 pulses/min

8.1.5 SSC1.x Param. SP2

Switch point 2 (only available in window mode and two-point mode):

- 2.1...24,000 pulses/min; factory setting: 2.1 pulses/min

8.1.6 SSC1.x Config. Logic

Switch-point logic:

- high active (NC)
- low active (NO, factory setting)

8.1.7 SSC1.x Config. Mode

Switch point mode:

- Single point (factory setting)
- Window
- Two point
- Deactivated

8.1.8 SSC1.x Config. Hysteresis

Switch point hysteresis:

- 10…30% (factory setting: 10%)

8.1.9 SSC1.x Delay. dS

Switching delay: Adjustable switch-on delay time of the output in ms

- 0…60,000 ms (factory setting: 0 ms)

8.1.10 SSC1.x Delay. dr

Switch-off delay: Adjustable switch-off delay time of the output in ms

- 0…60,000 ms (factory setting: 0 ms)

8.1.11 PrSC

Prescaler, divider to calculate the actual rpm:

- 1…99 (factory setting: 1)

See: Prescaler (→ 🗋 10)

8.1.12 Teach offset

Sets an offset between the switching threshold and the current process data value:

- 1…200% (factory setting: 80%)

See: Teach offset (→ 🗋 9)

8.1.13 TI Select

Teach selection:

- SSC1.1 (factory setting)
- SSC1.2

8.1.14 Access locks to the unit. Local parameter setting

This lock prevents the settings from being changed via the local operating elements on the unit:

- Locked
- Unlocked (factory setting)

8.1.15 dSt

Start-up delay time:

- 0…30,000 ms (factory setting: 10,000 ms)

See: Start-up delay (→ 9)

8.1.16 Application-Specific Tag

Customer-specific application description, max. 32 characters long.

Default value: “ *** ” / can be freely defined by the customer

8.1.17 Function Tag

Customer-specific function tag of the unit, max. 32 characters long.

Default value: “ *** ” / can be freely defined by the customer

8.1.18 Location Tag

Customer-specific location tag of the unit, max. 32 characters long.

Default value: “ *** ” / can be freely defined by the customer

8.1.19 Locator Start

Used to identify a unit. The LED quickly flashes green 2x per second.

8.1.20 Locator Stop

Deactivates the flashing of the LED. The LED indicates the device-specific operating states again.

8.1.21 Operating hours

Only counts full operating hours. Operating times of less than one full hour are not saved. Counter readings are saved permanently.

8.1.22 Internal temperature

Reads the data from the internal temperature sensor of the microcontroller.

8.2 Parameter setting via the unit keys

Unit locking

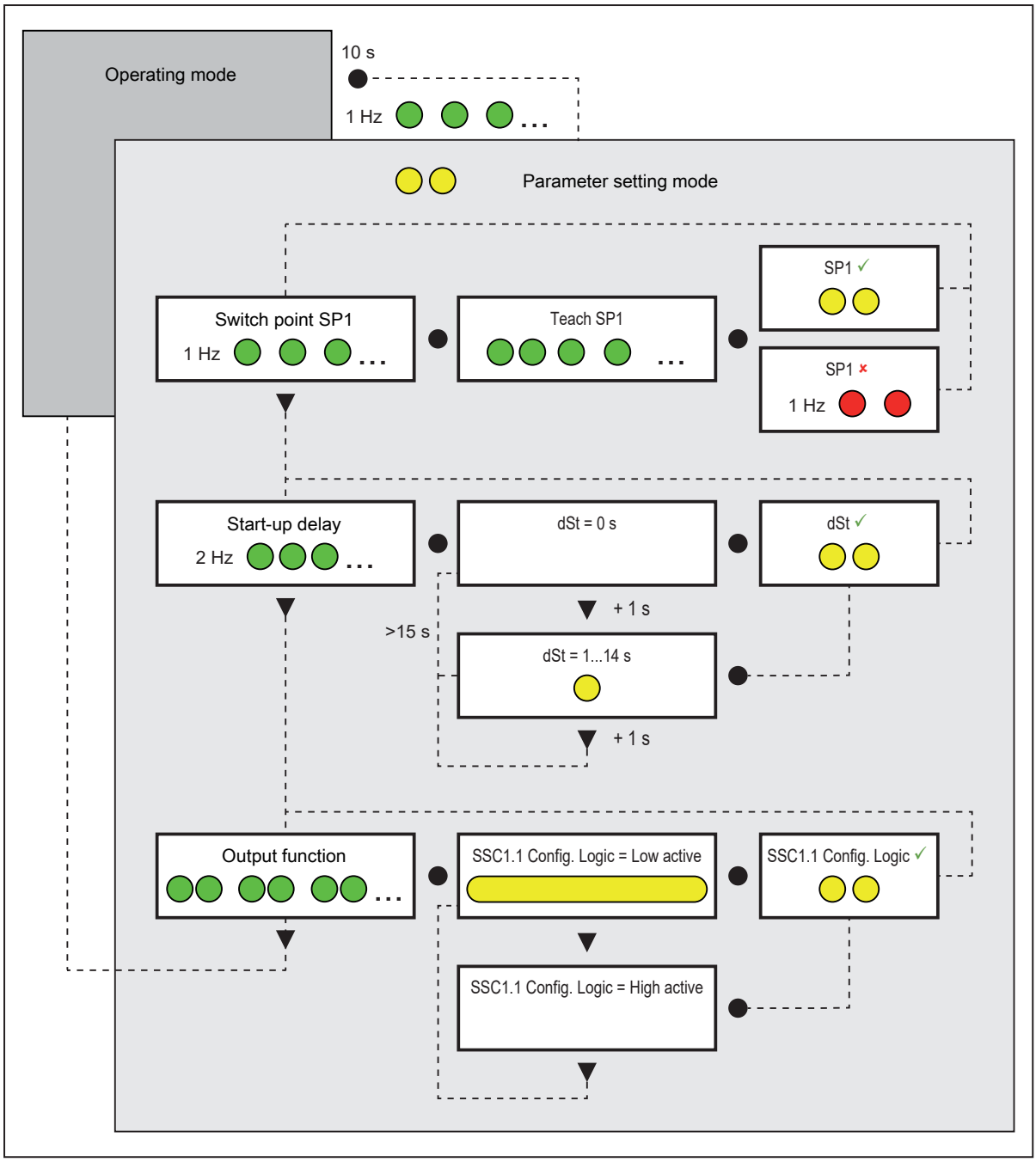
If the LED alternately flashes yellow and green when attempting to set parameters, local parameter setting is disabled. This locking can only be removed using an IO-Link parameter setting software. After unlocking, parameter setting is possible via the keys on the unit.

If no key is pressed for more than 120 s the unit will automatically exit the parameter setting or installation/set-up mode. Any unsaved parameter changes will be lost.

8.2.1 Parameter setting mode

The following parameters can be set via the unit keys:

1. Switch point SP1 (2.1...24,000 pulses/min; factory setting: 100 pulses/min)
2. Start-up delay (0…15 s, steps: 1 s; factory setting: 10 s)
   (Up to 30 s can be set via IO-Link.)
3. Output function OUT1 (NO/NC; factory setting: NO)



Parameter setting:

▶ Set the push ring to [●] for 10 s.
The LED flashes green with a frequency of 1 Hz during these 10 s.

▷ The LED flashes yellow twice for confirmation; then green with a frequency of 1 Hz.

▷ The unit is in the parameter setting mode for the switch point.

▶ Set the push ring to [▼] to change to the parameter setting mode for the start-up delay.
OR
Set the push ring to [●] to teach SP1.

▷ The LED flashes green with the damping frequency, however with a maximum frequency of 8 Hz.

▷ The unit is ready for SP1 teaching.

Wait at least one period before teaching SP1!
If PrSC=1, this corresponds to one revolution.

▶ Set the push ring to [●] to teach SP1 with the current damping frequency and save it.

▷ SP1 has been configured.

▷ The LED flashes yellow twice for confirmation; then green with a frequency of 1 Hz.

▷ The unit is still in the parameter setting mode for the switch point.

If the LED flashes red twice with a frequency of 1 Hz, teaching has failed.
The parameter change has not been saved.

▶ Set the push ring to [▼] to change to the parameter setting mode for the start-up delay.

▷ The LED flashes green with a frequency of 2 Hz.

▷ The unit is in the parameter setting mode for the start-up delay.

▶ Set the push ring to [▼] to change to the parameter setting mode for the output function.
OR
Set the push ring to [●] to set the time for the start-up delay.

▷ The LED is off.

▷ Time set for the start-up delay: 0 s

▶ Set the push ring to [●] to save this value.
OR
Each additional pressing of [▼] increases the start-up delay time by 1 s.

▷ Each time [▼] is pressed, the LED flashes yellow once. You can set a maximum of 15 s. If you press [▼] again after this, the LED does not flash and the current value is 0 s. Press [▼] to increase the time again in steps of 1 s.

▶ Set the push ring to [●] to save the set value.

▷ The LED flashes yellow twice for confirmation; then green with a frequency of 2 Hz.

▷ The unit is still in the parameter setting mode for the start-up delay.

▶ Set the push ring to [▼] to change to the parameter setting mode for the output function.

▷ The LED quickly flashes green twice per second.

▷ The unit is in the parameter setting mode for the output function.

▶ Set the push ring to [▼] to terminate the parameter setting of the unit.
OR
Set the push ring to [●] to set the output function.

▷ The LED lights yellow.

▷ The output function [Normally open] is set.

▶ Set the push ring to [●] to save this value.
OR
Set the push ring to [▼] to set the output function [Normally closed].

▷ The LED is off.

▷ The output function [Normally closed] is set.
Press [▼] again to change between [Normally open] (LED lights yellow) and [Normally closed] (LED off).

▶ Set the push ring to [●] to save the set value.

▷ The LED flashes yellow twice for confirmation; then it quickly flashes green twice per second.

▷ The unit is still in the parameter setting mode for the output function.

▶ Set the push ring to [▼] to terminate the parameter setting of the unit.

▷ The unit changes to the operating mode.

8.2.2 Installation/set-up mode

In this mode, the damping state is indicated via the the green LED. The actual damping frequency is indicated up to a frequency of 8 Hz.

✓ The unit is in the operating mode.

▶ Set the push ring to [▼] to change to the installation/set-up mode.

▷ The unit is in the installation/set-up mode.

▶ Damping of unit.

▷ LED lights green.

▶ No damping of unit.

▷ LED does not light.

▶ Set the push ring to [▼] or [●] to terminate the installation/set-up mode.

▷ The unit changes to the operating mode.

8.2.3 Reset application

The application-specific parameters can be reset to the factory settings while the parameters for identification remain unchanged:

✓ The unit is disconnected from the supply voltage.

▶ Set the push ring to [▼] and apply the supply voltage.

▶ To confirm, set the push ring to [●] within 10 s.

▷ The LED flashes yellow twice for confirmation.

▷ The application-specific parameters have been reset to the factory settings.

8.3 Teach

The switching threshold is set via the teach function. This can also be done when the unit is installed as well as with constant-speed equipment.

The IO-Link commands [Teach SP1] and [Teach SP2] allow you to teach both switching thresholds separately. The keys on the unit only let you teach SP1.

During teaching the current measured value is saved as the switching threshold, taking into account the set teach offset (SP_{Teach} = current measured value * teach offset).

The parameter [TI Select] determines whether SSC1.1 or SSC1.2 is taught.

The lower switch point must be at least 10% lower than the higher switch point. This difference between the switching thresholds is checked during teaching. Switch points that are closer together cannot be saved.

The switching thresholds must be between 2.1 pulses/min and 24,000 pulses/min.
SP-H must be ≥ 0 pulses/min.
SP+H must be ≤ 32,000 pulses/min.
H is the set hysteresis. Values between 10% and 30% are possible.

9 Operation

The operation is maintenance-free.

Ensure the following for a correct function:

- ▶ Keep the sensing face and the clear space free of metal deposits and foreign bodies.
- ▶ Do not operate devices with high field intensity (e.g. mobile phones) at close range to the speed monitor.

10 Maintenance, repair and disposal

The operation of the unit is maintenance-free.

Only the manufacturer is allowed to repair the unit.

▶ After use dispose of the device in an environmentally friendly way in accordance with the applicable national regulations.