

DFS51 - Instructions



IO-Link Compatible

Features:

- IO-Link compatible (COM3)
- Intuitive numerical diagnostic OLED display
- Attractive 10mm wide housing
- Low power & wide operating voltage
- Crosstalk rejection between two sensors
- Configurable Q2 (Output/Remote set)
- High-speed, High-resolution, and Long-range modes
- Combinable dual timers
- CE approved

How To Specify

- 1. Select Sensor: DFS51**
Digital
Fiber Optic Sensor
- 2. Select Light Source:**
R = Red
I = Infrared
- 3. Select Connection:**
Blank = 6ft cable (1.8m)
C = 4-pin M8 connector

Example: DFS51 R C
DFS Digital Fiber Optic Sensor
Light Source
Connection

Features

WIDE VARIETY OF FIBERS

Visit www.ttco.com for full listing.

AUTOSET (●)

Push to perform AUTOSET.

THRESHOLD/VALUE ADJUST ROCKER (▼▲)

1. Manually adjusts the threshold. +/-
2. Alters programming parameters. +/-
Hold to scroll for numeric values.

MODE (■)

1. Tap to display sensor status screen.
2. Tap again to access parameters.

CONNECTION

4-Pin M8 connector or built-in cable.

FIBER RELEASE CLAMP

Locks fibers in place.

OUTPUT LEDS

1. Illuminates solid when output is ON.
2. Flashes when output is overloaded.

ADVANCED DIAGNOSTIC OLED DISPLAY

See next page for complete listing.

IO-LINK STATUS LIGHT RING

Blinks out when IO-LINK is activated.

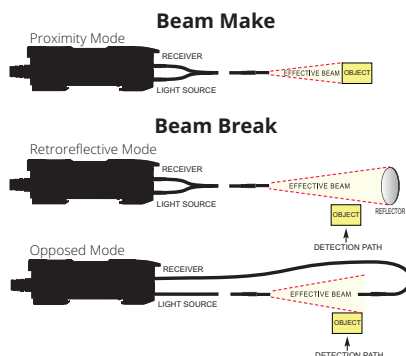
Note: Only available on connector models.

Quick Start The Digital Fiber Optic Sensor is designed to provide reliable detection using fiber optic light guides. Sensor is adjusted by a single push of a button; there is no guess work on the part of the operator. The sensor *default settings** (Light State) will work for most applications.

Follow the three step procedure below:

* Note: Consult all default settings on page 7.

- 1.** Establish one of the following conditions:
Beam Make/Proximity - Reflect light off object.
Beam Break - Remove object from light beam path.

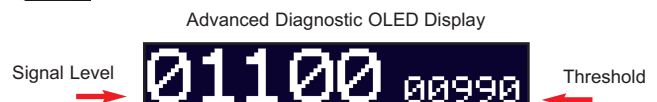


- 2.** Tap **AUTOSET** (●) button:



Pressing the AUTOSET button sets the sensors threshold to the desired level.

- 3.** Verify setup on advanced diagnostic OLED display. If needed, the threshold can be altered by tapping up or down on the threshold adjust rocker.



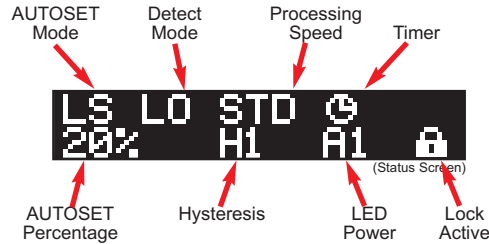
Programming



The DFS performance, AUTOSET function, output configuration, and other features can be tailored to your unique application. Follow the programming procedure contained in this section.



Tap **MODE** (■) to show status screen. Status Screen shows a quick overview of sensor's settings.



Note: Programming will time out after 60 seconds if no action is taken. Tap and hold to exit status screen.



Tap **MODE** (■) again to access first parameter. Continue tapping to select desired parameter. Use the threshold/value **ADJUST ROCKER** (▼▲) to select or adjust a specific parameter.

AUTOSET Modes

The sensor's automatic threshold adjustment is controlled by the AUTOSET mode. Each AUTOSET mode sets the threshold differently. Select the mode that works best for your specific application. See details at the left.



AUTOSET Mode:	Light State	LS
AUTOSET Mode:	Dark State	DS
AUTOSET Mode:	Midpoint	MP
AUTOSET Mode:	Two-Point	2P
AUTOSET Mode:	Dynamic	DY

Light-State Set (LS): Sets threshold below received light beam intensity.

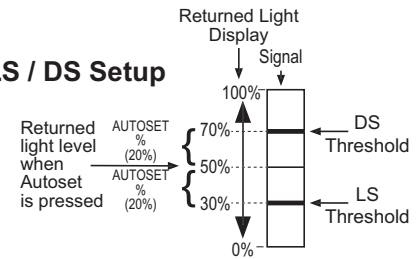
Dark-State Set (DS): Sets threshold above received light beam intensity.

Midpoint Set (MP): Sets threshold at received light beam intensity.

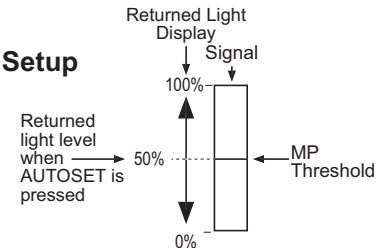
Two-point Set (2P): Sets threshold between received light beam intensity two point.

Dynamic Set (DY): Sets threshold between received light beam high and low intensity.

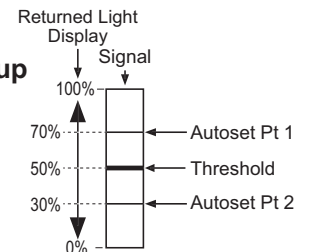
LS / DS Setup



MP Setup



2P or DY Setup



AUTOSET Percent

For Light State (LS), and Dark State (DS), the offset percentage is adjustable. AUTOSET Percent determines threshold placement during AUTOSET. Placement is a percentage of received light beam intensity.

ADJUST 1% - 90% (Hold to scroll)



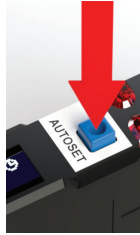
Using AUTOSET

The DFS threshold is set automatically by pressing the AUTOSET button.

There are six different ways the sensor determines the threshold. The user first must determine which type of setup mode is appropriate for the application. The simplest and most common mode we recommend is Light State (LS) setup. It is used in both beam make and beam break sensing. When using this mode, the sensor will provide the best sensitivity to fine changes in light level or contrast. This is useful for small part detection and precise leading-edge triggering. Please consult our website at

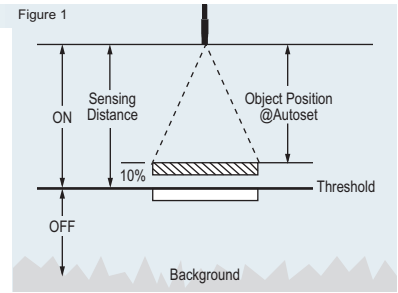
<https://www.tco.com/sensors/fundamentals> or contact one of our worldwide distributors for application help. We look forward to providing any assistance you may need.

Note: OLED display will provide intuitive visual feedback during autosetting. Paying close attention to the display is important.



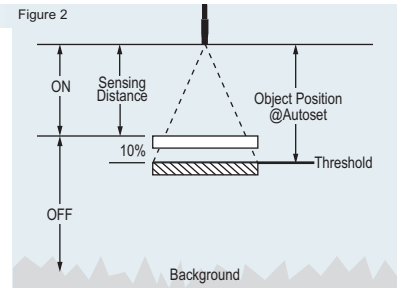
Light State (Default)

Place object to be detected in the worst-case light-state condition and press the AUTOSET button. The threshold will be set 10%(default) below the received light-beam intensity. The threshold can be altered by tapping up or down on the threshold adjust rocker (see Figure 1).



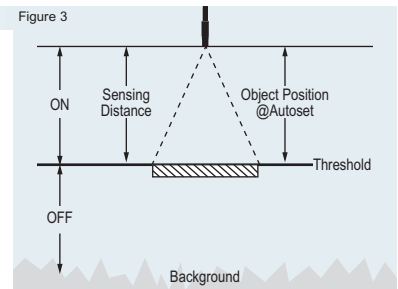
Dark State

Place object to be detected in the worst-case dark-state condition and press the AUTOSET button. The threshold will be set 10%(default) above the received light-beam intensity. The threshold can be altered by tapping up or down on the threshold adjust rocker (see Figure 2).



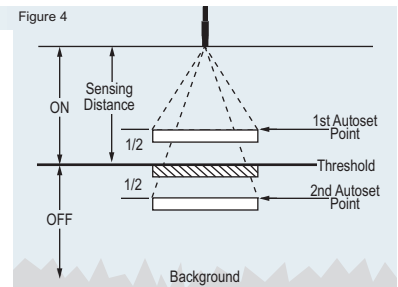
Midpoint

Place object to be detected in position at which you want the threshold to be set and press the AUTOSET button. The threshold can be altered by tapping up or down on the threshold adjust rocker (see Figure 3).



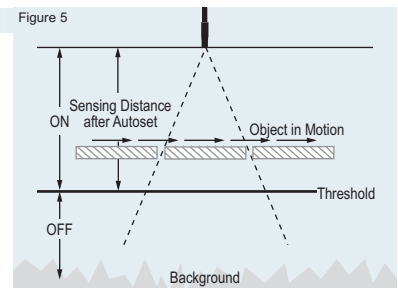
Two-Point

Place object to be detected in the light-state condition and press the AUTOSET button. Then remove or place the object in the dark-state condition and press the AUTOSET button again. The threshold will be set between the two light-beam intensities. The threshold can be altered by tapping up or down on the threshold adjust rocker (see Figure 4).



Dynamic

Press the AUTOSET button to start the Dynamic AUTOSET. Now move the object through the beam at least once and press the AUTOSET button again to complete the Dynamic AUTOSET. The threshold is set between the highest and lowest received light levels caused by the object being passed through. The threshold can be altered by tapping up or down on the threshold adjust rocker (see Figure 5).



Detect Mode

Sensor output activates or deactivates when received light intensity is over the threshold. *Not available when input function is set to Remote Dark On.*

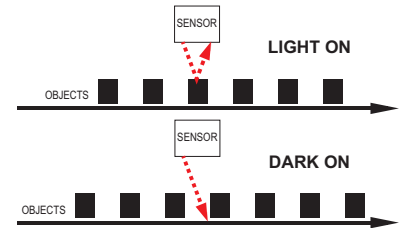


Detect Mode:
Light/High On

Detect Mode:
Dark/Low On

Light/High On (LO): Output activates when received light intensity is over the threshold. *Note: In window mode (WN) output activates when received light intensity is inside the window thresholds.*

Dark/Low On (DO): Output deactivates when received light intensity is over the threshold. *Note: In window mode (WN) output activates when received light intensity is outside the window thresholds.*



Response Time

Select which mode that best fits the performance need of your application. Sensor speed, range, and sensitivity are optimized for best performance.



Response Time:
Ultra-High-Speed

Response Time:
High-Speed

Response Time:
Standard

Response Time:
High-Resolution

Response Time:
Long-Range

Response Time:
Ultra-Long-Range

Ultra-High-Speed (UHS): Fastest response time (50µs). *Not available in Asynchronous Anti-Crosstalk Mode.*

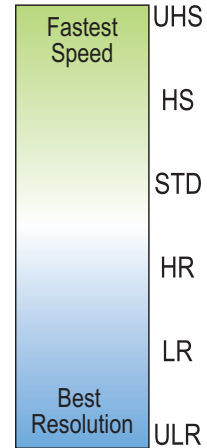
High-Speed (HS): Fast response time with higher sensitivity (125µs). *Not available in Asynchronous Anti-Crosstalk Mode.*

Standard (STD): Good balance of response time and range for general purpose sensing (250µs).

High-Resolution (HR): Improved resolution for general purpose sensing (1ms).

Long-Range (LR): General purpose sensing with improved range (4ms).

Ultra-Long-Range (ULR): Special purpose sensing with maximum sensitivity and range (16ms).



LED Power

Select the emitter LED power.



LED Power:
Auto A1

LED Power:
High Power P1

LED Power:
Low Power P0

Auto (A0/A1): Automatically determined during AUTOSET.

High Power (P1): Boosts power when signal level is low. Example: long range.

Low Power (P0): Cuts power to prevent saturation. Example: short range.

Hysteresis

To avoid false triggers for example due to object vibration. Adjusts the span between the operate point and the release point of the sensor output. Low hysteresis increases sensitivity and high hysteresis increases sensing stability.



Hysteresis:
Low H0

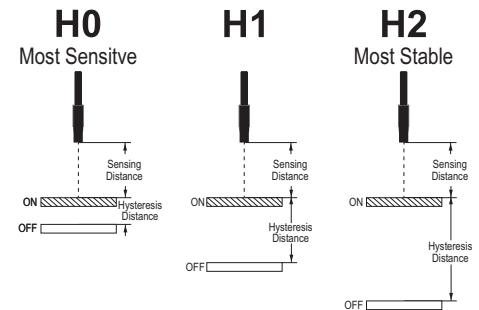
Hysteresis:
Standard H1

Hysteresis:
High H2

Low (H0): Reduced hysteresis for increased sensitivity.

Standard (H1): Automatic adjustment depending on signal level.

High (H2): Increased hysteresis for increased stability.



Anti-Crosstalk

Turns on Asynchronous Anti-Crosstalk rejection for two sensors. *Note: Channels 1 and 2 cannot be set as Channels A and B; anti-crosstalk is for use of two separate sensors. Not available for UHS and HS modes.*



Anti-Crosstalk:
Disabled

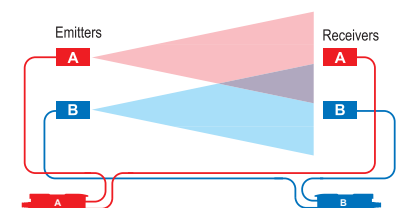
Async Crosstalk:
Channel A xA

Async Crosstalk:
Channel B xB

Disabled: Turns off Anti-Crosstalk rejection.

Assign one sensor to channel A and the other to channel B.

Asynchronous Crosstalk



PRESS

Timer/Counter Function #:

Choose from ten pre-configured timer control functions. Each one represents a function such as on-delay, off-delay, etc. Once a function is selected, adjustable parameters of that function appear such as delay time.

ADJUST

**Timer Duration**

On Delay:
10.0ms

0.1 - 9999.9ms

Hold up or down to scroll.

Select

00

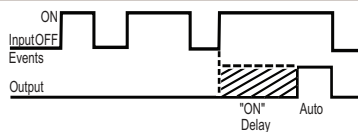
Timer Func: 00
Bypass

Timer not used.

01

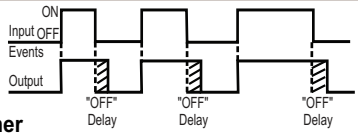
Timer Func: 01
On-Delay

"ON" Delay

**02**

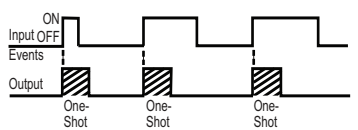
Timer Func: 02
Off-Delay

"OFF" Delay Pulse Stretcher

**03**

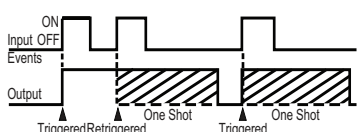
Timer Func: 03
One-Shot

One-Shot

**04**

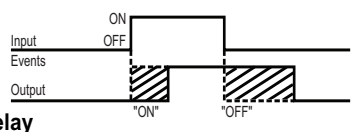
Timer Func: 04
Motion

Motion Detection

**06**

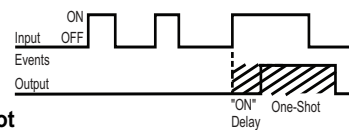
Timer Func: 06
On, Off-Delay

"ON" Delay then "OFF" Delay

**07**

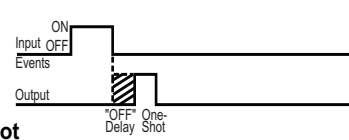
Timer Func: 07
On, One-Shot

"ON" Delay, then One-Shot

**09**

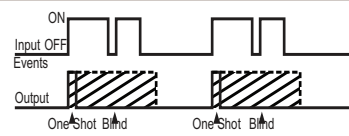
Timer Func: 09
Off, One-Shot

"OFF" Delay then One-Shot

**11**

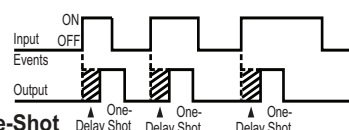
Timer Func: 11
Blind One-Shot

Blind One-Shot

**12**

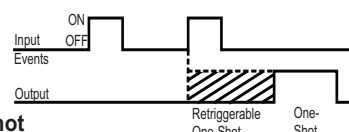
Timer Func: 12
Delayed One-Shot

One-Shot Delay, then One-Shot

**14**

Timer Func: 14
Stop, One-Shot

Stop Motion, then One-Shot



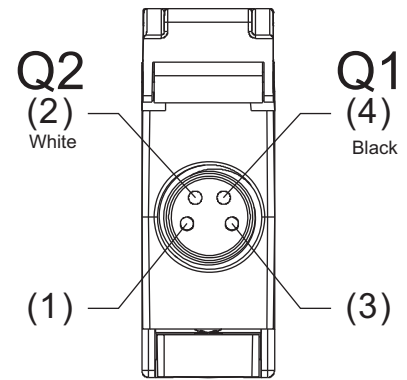
Numbers not listed are not available on this model.

■ Q2 IO Function

The Q2 (white wire) is configurable as an output, or as an remote set input.

Select ▲ ▼	Q2: Disabled	Disabled: To ignore unwanted signals.
	Q2: Output PNP - Source	PNP - Source: PNP transistor open collector output.
	Q2: Output NPN - Sink	NPN - Sink: NPN transistor open collector output.
	Q2: Output Push/Pull	Push/Pull: NPN and PNP transistor connected in a push/pull configuration.
	Q2: Remote Set Active High	Active High: Selects active High Remote Set.
	Q2: Remote Set Active Low	Active Low: Selects active Low Remote Set.

The DFS51 Q2 pin is configurable.



■ Display Orientation

Flips orientation 180 degrees..



■ Settings Lock

Locks buttons. *Note: Input wire remains unlocked.*

Select ▲ ▼	Settings: Unlocked	Unlocked: Adjustments can be made easily.
	Settings: Locked	Locked: Prevents unauthorized tampering. To unlock, tap MODE to scroll through menu to Settings Lock and select Unlocked to unlock.

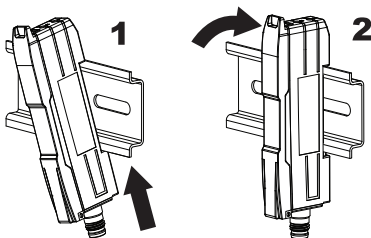
Default Setting Chart		
PARAMETER	Default	
AUTOSET MODE	Light-State	Other options: Dark-State, Midpoint Two-point, Dynamic
AUTOSET PERCENT	10%	Other options: 1% - 90%
DETECT MODE	Light On	Other option: Dark On
RESPONSE TIME	Standard	Other options: Ultra-High-Speed, High-Speed, High-Resolution, Long-Range, Ultra-Long-Range
LED POWER	Auto	Other options: Low, High
HYSTERESIS	Standard	Other options: Low, High
ANTI-CROSSTALK	Disabled	Other options: Asynchronous Channel A, Asynchronous Channel B
TIMER	Bypass	Other options: Various
TIMER DURATION	10ms	Other options: 000.1ms - 9999.9ms
Q2 IO FUNCTION	Disabled	Other options: PNP, NPN, Push/Pull, Active High, Active Low
DISPLAY	Standard	Other options: Inverted
SETTINGS LOCK	Unlocked	Other option: Locked

Factory Reset

Hold down MODE (■) on power up, then tap up or down (▲▼).
Sensor will return to all settings to factory default (see chart above).

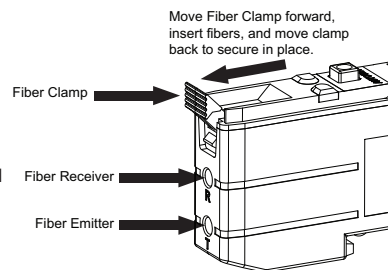
Mounting on a DIN Rail

1. Hook the DIN rail clip on the bottom of the sensor under the edge of the DIN rail.
2. Gently push and pivot the sensor onto the DIN rail, pressing until it snaps into place.



Installing the Fibers

1. Open the dust cover.
2. Move the fiber clamp forward to unlock it.
3. Insert the fiber(s) into the fiber port(s) until they stop.
4. Move the fiber clamp backward to secure the fiber(s).
5. Close the dust cover.



Specifications

SUPPLY VOLTAGE & CURRENT

- 8-30 Vdc
- 28ma @ 24Vdc, 49ma @ 12Vdc
- Reverse polarity protected
- Transient spike protected

OUTPUT / INPUT

- Q1 - Push/Pull
- Q2 - Configurable: PNP - Source, NPN - Sink, Push-Pull, Active High, or Active Low
- 150mA output current
- Short circuit & transient spike protected
- Saturation voltage: < 0.3Vdc @ 10mA < 2Vdc @ 150mA

POWER-UP DELAY

- 350ms. No output pulse on power-up.

RESPONSE TIME (Dependent on Mode)

- Ultra-High-Speed (UHS) 50µs
- High-Speed (HS) 125µs
- Standard (STD) 250µs
- High-Resolution (HR) 1ms
- Long-Range (LR) 4ms
- Ultra-Long-Range (ULR) 16ms

REPEATABILITY (Dependent on Mode)

- UHS 12µs.
- HS, STD, HR, LR, ULR (15.635µs)
- Asynchronous crosstalk enabled (31.25µs)

IO-LINK ADJUSTABLE SWITCHING SENSOR SUPPORTING:

- Fast COM3 Communications
- 1ms Cycle Time
- Smart Sensor Profile 2nd Edition
- SSP2.4 Single Value Teach
- SSP2.5 Two Value Teach
- SSP2.6 Dynamic Teach

MAXIMUM RANGE

(RED)

Opposed Mode

- UHS 20in (508mm)
- HS 28in (711mm)
- STD 32in (813mm)
- HR 47in (1193mm)
- LR 60in (1524mm)
- ULR 75in (1905mm)

Proximity Mode

- UHS 8in (203mm)
- HS 11in (279mm)
- STD 13in (330mm)
- HR 16in (406mm)
- LR 21in (533mm)
- ULR 28in (711mm)

When anti-crosstalk is enabled maximum range specifications are reduced 30%.

Note: Opposed tests utilized: PF-Z-78TL (red);

MDF-B-36T (infrared)

Proximity tests utilized: PFD-Z-78M64 (red);

MDBF-E-36T (infrared)

LIGHT IMMUNITY

- High immunity to most ambient light, including high efficiency lighting and high intensity strobes.

MUTUAL INTERFERENCE REJECTION

- Asynchronous: Two sensor max. responds to selected A or B Channel.

COMBINABLE DUAL TIMERS

- On-Delay, Off-Delay, One-Shot, Motion
- Timer range: 0.1 - 0.9ms, 1ms - 9,999ms

EMITTER LIGHT SOURCE

- 4 element LED, Red = 660nm
- IR = 880nm (Use glass fibers with Ø2.2mm connection only).

DISPLAY

- 96 X 16 white dot matrix OLED
- Display numerical range depended on processing mode
- UHS - 1,023
- HS - 2,047
- STD - 4,095 (default setting)
- HR - 16,383
- LR - 32,767
- ULR - 32,767 (max reading)

LED INDICATORS

- Output: Red LED. Illuminates when output is ON. Flashes when output is overloaded.
- Connector: Rear Green IO-Link status Indicator.

CONNECTIONS

- M8, 4-pin
- Attached cable: 4-wire 6ft (1.8m)

OPERATING TEMPERATURE

- 5°C to 55°C (41°F to 131°F) - Electrical.

HOUSING CONSTRUCTION

- Chemical resistant, high-impact polycarbonate

RATINGS & CERTIFICATIONS

- IP50
- CE
- UL pending



RoHS Compliant
Product subject to change without notice

Dimensions

DFS51 Digital Fiber Optic Sensor

