

# DFS12 - Instructions



## Features:

- Intuitive numerical/percentage diagnostic OLED display
- Attractive 10mm wide housing
- Low power & wide operating voltage
- Advanced remote programming
- Six **AUTOSET** modes including window
- Crosstalk rejection between two sensors without a wire
- Programmable input configurations
- High-speed, High-resolution, and Long-range modes
- Combinable dual timers, and counters
- CE approved

## How To Specify

**1. Select Sensor: DFS12**  
Digital Fiber Optic Sensor

**2. Select Output Type:**  
N = NPN  
P = PNP

**3. Select Light Source:**  
R = Red  
I = Infrared

**4. Select Connection:**  
Blank = 6ft cable (1.8m)  
C = 4-pin M8 connector

**Example:** DFS12 N R C

DFS Digital Fiber Optic Sensor

Output Type

Light Source

Connection

## Features

**WIDE VARIETY OF FIBERS**  
Visit [www.ttco.com](http://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.

**INPUT FUNCTION LIGHT RING**  
Illuminates when input is activated.

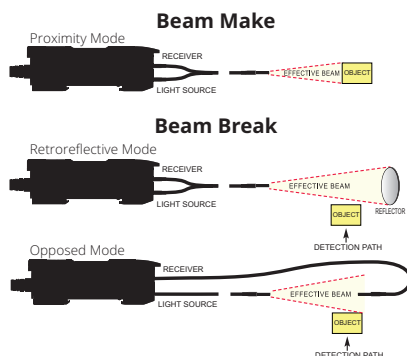
*Note: Only available on connector models.*

**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 6.

- 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.

Advanced Diagnostic OLED Display

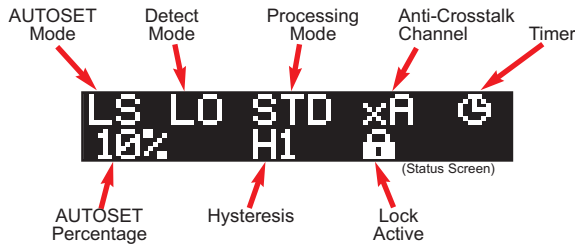
Signal Level → **01100** 00990 ← Threshold

# Programming



The DFS performance, AUTOSET function, 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.

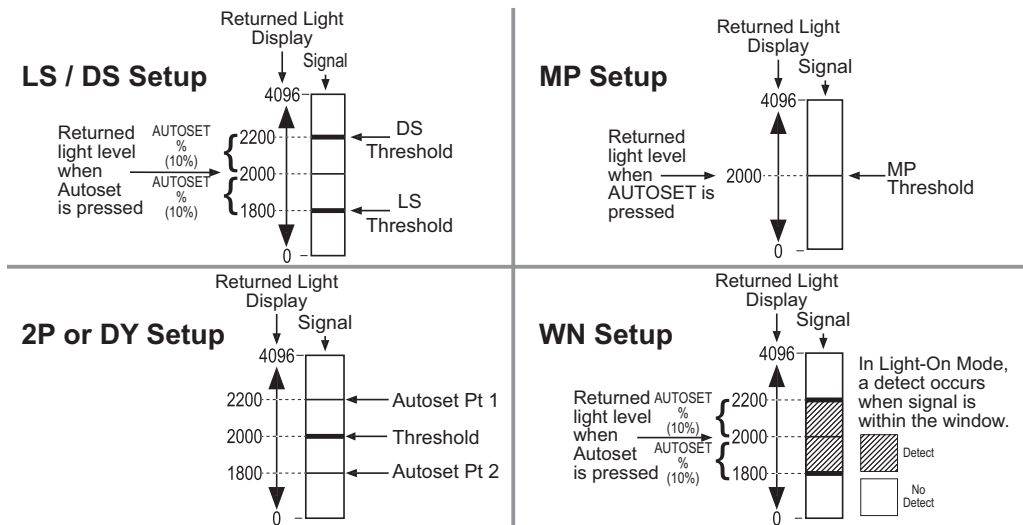


## AUTOSET Modes

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** **Light-State Set (LS):** Sets threshold below received light beam intensity.
- AUTOSET Mode: Dark State DS** **Dark-State Set (DS):** Sets threshold above received light beam intensity.
- AUTOSET Mode: Midpoint MP** **Midpoint Set (MP):** Sets threshold at received light beam intensity.
- AUTOSET Mode: Two-Point 2P** **Two-point Set (2P):** Sets threshold between received light beam intensity two point.
- AUTOSET Mode: Dynamic DY** **Dynamic Set (DY):** Sets threshold between received light beam high and low intensity.
- AUTOSET Mode: Window WN** **Window Set (WN):** Sets two thresholds equally spaced above and below received light beam intensity. Received light beam intensity within the window is a valid detect. Outside the window is not a valid detect.



## AUTOSET Percent

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

ADJUST 1% - 50% (Hold to scroll)



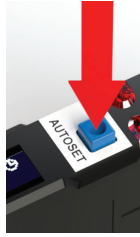
# Using AUTOSET

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

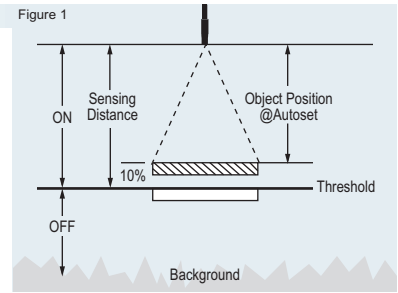
<https://www.tco.com/sensors/fundamentals> or contact one of our worldwide distributors for application help. We look forward to providing any assistance you may need.

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



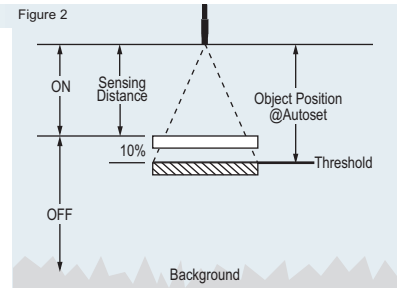
## Light State (Default)

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).



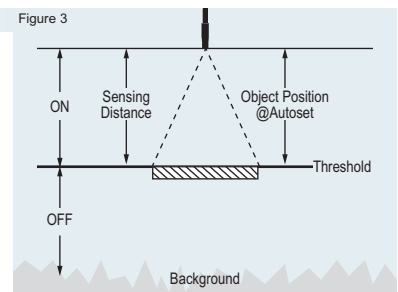
## Dark State

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).



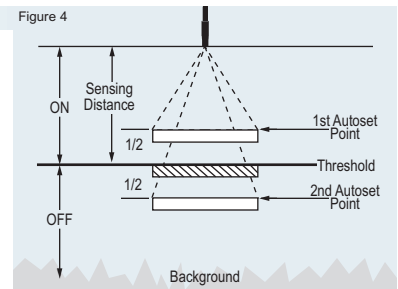
## Midpoint

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).



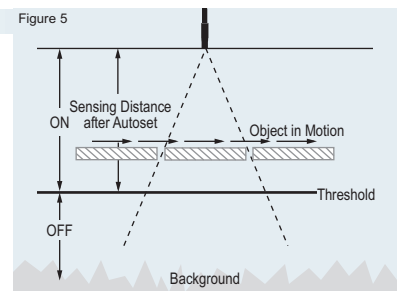
## Two-Point

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 adjust can be altered by tapping up or down on the threshold adjust rocker (see Figure 4).



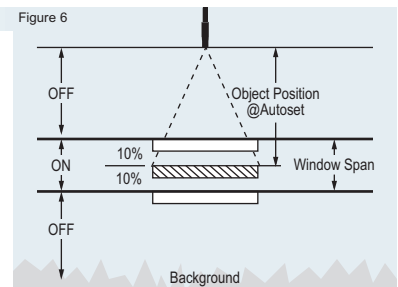
## Dynamic

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).



## Window

Window mode is a unique type of AUTOSET mode. Window mode creates two thresholds and can be used in a similar manor as a dual channel fiberoptic sensor. Place the object in the position at which you want to be reliably detect it and press the AUTOSET button. The DFS will place two thresholds 10%(default) higher and 10%(default) lower than the returned light level. Now when the object is passed in view or through the fiberoptic the object will be detected in the same position +/- 10%. The 10% threshold window span can be altered by tapping up or down on the threshold adjust rocker (see Figure 6).



## 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.*

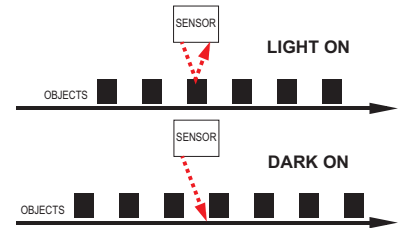


Detect Mode:  
Light On LO

**Light 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.*

Detect Mode:  
Dark On DO

**Dark 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

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

Response Time:  
High-Speed

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

Response Time:  
Standard

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

Response Time:  
High-Resolution

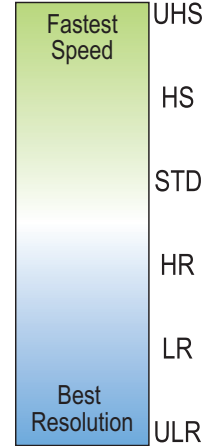
**High-Resolution (HR):** Improved resolution for general purpose sensing (1ms).

Response Time:  
Long-Range

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

Response Time:  
Ultra-Long-Range

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



## 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

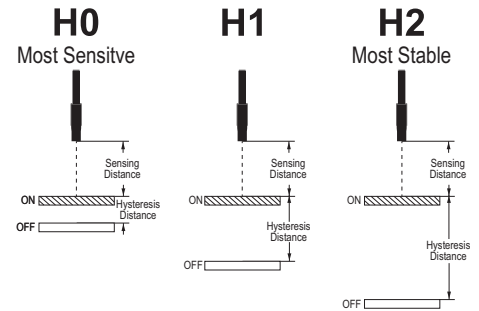
**Low (H0):** Reduced hysteresis for increased sensitivity.

Hysteresis:  
Standard H1

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

Hysteresis:  
High H2

**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

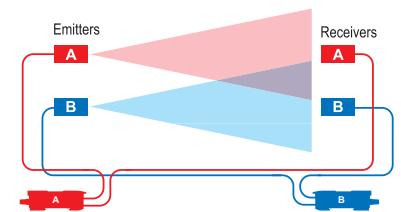
**Disabled:** Turns off Anti-Crosstalk rejection.

Async Crosstalk:  
Channel A xA

Async Crosstalk:  
Channel B xB

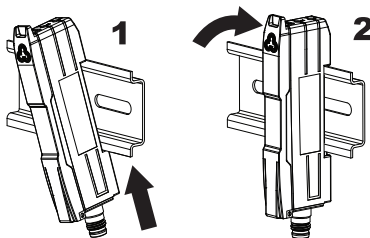
Assign one sensor to channel A and the other to channel B.

## Asynchronous Crosstalk



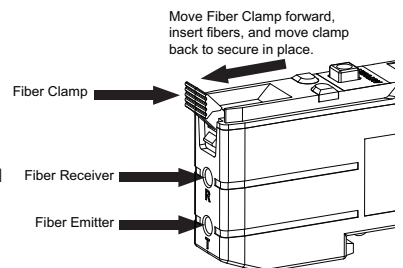
## Mounting on a DIN Rail

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.



**PRESS Timer/Counter Function #:**

Choose from 19 pre-configured timer/counter 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.

**Timer Duration**  
 On Delay: 10ms  
 0.1 - 9.9, 10 - 9999ms  
 Hold up or down to scroll.

**Counter**  
 Count: 0005  
 0001-9999  
 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**

**05**  
 Timer Func: 05  
 Latch  
**Latching, Edge Triggered**

**06**  
 Timer Func: 06  
 On, Off-Delay  
**"ON" Delay then "OFF" Delay**

**07**  
 Timer Func: 07  
 On, One-Shot  
**"ON" Delay, then One-Shot**

**08**  
 Timer Func: 08  
 On, Latch  
**"ON" Delay then Latch**

**09**  
 Timer Func: 09  
 Off, One-Shot  
**"OFF" Delay then One-Shot**

**10**  
 Timer Func: 10  
 Off, Latch  
**"OFF" Delay then Latch**

**11**  
 Timer Func: 11  
 Blind One-Shot  
**Blind One-Shot**

**12**  
 Timer Func: 12  
 Delayed One-Shot  
**One-Shot Delay, then One-Shot**

**13**  
 Timer Func: 13  
 Delayed Latch  
**One-Shot Delay, then Latch**

**14**  
 Timer Func: 14  
 Stop, One-Shot  
**Stop Motion, then One-Shot**

**15**  
 Timer Func: 15  
 Stop, Latch  
**Stop Motion, then Latch**

**16**  
 Timer Func: 16  
 Latch, On-Delay  
**Latch then "ON" Delay**

**17**  
 Timer Func: 17  
 Latch, One-Shot  
**Latch, then One-Shot**

**18**  
 Timer Func: 18  
 Count, One-Shot  
**Count, One-Shot**

**19**  
 Timer Func: 00  
 Count, Latch  
**Count, Latch**

## Input Functions

Select input to be performed:

Select ▲▼	Input Function: Disabled	<b>Disabled:</b> To ignore unwanted signals.
	Input Function: Remote Set	<b>Remote set:</b> An AUTOSET function is performed when input wire is transitioned from idle to active and returned. <i>Note: input wire can be used in addition to the AUTOSET button.</i>
	Input Function: Remote Command	<b>Remote command:</b> Sensor parameters can be adjusted via defined pulses. See chart on page 7.
	Input Function: Interrogate	<b>Interrogate:</b> Sensor output is latched when input wire is transitioned from idle to active.
	Input Function: Gate	<b>Gate:</b> Sensing is gated. Detection is enabled when input is active.
	Input Function: Remote Dark On	<b>Remote Dark On:</b> Detect Mode is determined by input state. Dark On mode is used when input is active.
Input Function: Remote Lockout	<b>Remote Lockout:</b> Remote lock of the AUTOSET, up and down adjust and most mode	

## Display Mode

Selects between numeric and percentage modes and flips orientation.

Select ▲▼	Display Mode: Numeric	04095 00016	FIBER	CABLE
	Display Mode: Percentage	99.9% 01.0%	FIBER	CABLE
	Display flips 180 degrees.			
	Display Mode: Numeric	00016 04095	CABLE	FIBER
Display Mode: Percentage	01.0% 99.9%	CABLE	FIBER	

## Lock Mode

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

Select ▲▼	Button Lock: Disabled	<b>Disabled:</b> Adjustments made by anyone.	Sensor Locked
	Button Lock: Enabled	<b>Enabled:</b> Prevents unauthorized tampering. To unlock, tap MODE to scroll through menu to Button Lock and select Disabled to unlock.	Displayed when sensor is locked.

## Default Setting Chart

PARAMETER	Default	
AUTOSET MODE	Light-State	Other options: Dark-State, Midpoint Two-point, Dynamic, Window
AUTOSET PERCENT	10%	Other options: 1% - 50%
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
HYSTERESIS	Standard	Other options: Low, High
ANTI-CROSSTALK	Disabled	Other options: Asynchronous Channel A, Asynchronous Channel B
TIMER	Bypass	Other options: Timer 1-19
TIMER DURATION	10ms	Other options: 0001 - 9999ms
INPUT FUNCTIONS	Disabled	Other options: Remote Set, Remote Command, Interrogate, Gate, Remote Dark On, Remote Lockout
DISPLAY MODE	Numeric	Other options: Percentage, Numeric Flipped, Percentage Flipped
LOCK MODE	Disabled	Other option: Enabled

## 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).

# Remote Command Programming

In Remote Command Mode a limited set of options can be configured via the input wire. This is accomplished by sending a simple sequence of pulses on Q2 (white wire). For example, sending a sequence of two pulses followed by three pulse followed by two pulses selects dark on mode.

**Example of 2 - 3 - 3 pulse command**



Pulse width (P) is 40ms - 400ms.  
The delay between sets of pulses (D) is 0.75 - 5 seconds.

Pulses are displayed while being received. Valid commands are executed immediately. Holding the input active will cancel a partial command.

## AUTOSET

A single pulse command initiates an AUTOSET. A second single pulse command is required to complete Two-Point and Dynamic AUTOSETs.

Setting	Option	Icon	Pulse Sequence	Notes
AUTOSET			1	A single pulse initiates AUTOSET. An additional pulse command is required to complete AUTOSET for two-point and dynamic modes.
AUTOSET Mode	Light-State	LS	2 - 1 - 1	
	Dark-State	DS	2 - 1 - 2	
	Midpoint	MP	2 - 1 - 3	
	Two-Point	2P	2 - 1 - 4	
	Dynamic Set	DY	2 - 1 - 5	
	Window	WN	2 - 1 - 6	
AUTOSET Percent	1%	01%	2 - 2 - 1	Percentage will affect the next Light, Dark AUTOSET.
	2%	02%	2 - 2 - 2	
	5%	05%	2 - 2 - 3	Immediate effect on Window Size
	10%	10%	2 - 2 - 4	
	20%	20%	2 - 2 - 5	
	50%	50%	2 - 2 - 6	
Detect Mode	Light On	LO	2 - 3 - 1	
	Dark On	DO	2 - 3 - 2	
Response Time	Ultra-High-Speed	UHS	2 - 4 - 1	Anti-Crosstalk Disabled
	High-Speed	HS	2 - 4 - 2	Anti-Crosstalk Disabled
	Standard	STD	2 - 4 - 3	
	High Resolution	HR	2 - 4 - 4	
	Long-Range	LR	2 - 4 - 5	
	Ultra-Long-Range	ULR	2 - 4 - 6	
Hysteresis	Low	H0	2 - 5 - 1	
	Standard	H1	2 - 5 - 2	
	High	H2	2 - 5 - 3	
Anti-Crosstalk	Disabled		2 - 6 - 1	
	Async-Channel A	xA	2 - 6 - 2	
	Async-Channel B	xB	2 - 6 - 3	
Timer Function	Bypass		3 - 1 - 1	
	On-Delay	⌚	3 - 1 - 2	
	Off-Delay	⌚	3 - 1 - 3	
	One-Shot	⌚	3 - 1 - 4	
	Motion	⌚	3 - 1 - 5	
	On, Off-Delay	⌚	3 - 1 - 6	
	On, One-Shot	⌚	3 - 1 - 7	
	Off, One-Shot	⌚	3 - 1 - 8	
	Blind One-Shot	⌚	3 - 1 - 9	
	Delayed One-Shot	⌚	3 - 1 - 10	
Stop, One-Shot	⌚	3 - 1 - 11		
Timer 1 Duration	1ms		3 - 2 - 1	
	2ms		3 - 2 - 2	
	5ms		3 - 2 - 3	
	10ms		3 - 2 - 4	
	20ms		3 - 2 - 5	
	50ms		3 - 2 - 6	
Timer 2 Duration	1ms		3 - 3 - 1	
	2ms		3 - 3 - 2	
	5ms		3 - 3 - 3	
	10ms		3 - 3 - 4	
	20ms		3 - 3 - 5	
	50ms		3 - 3 - 6	
Button Lock	Disabled		4 - 1 - 1	
	Enabled	🔒	4 - 1 - 2	
Display Mode	Numeric		4 - 2 - 1	
	Percentage		4 - 2 - 2	
	Numeric (Flipped)		4 - 2 - 3	
	Percentage (Flipped)		4 - 2 - 4	

# Specifications

## SUPPLY VOLTAGE & CURRENT

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

## OUTPUT

- NPN or PNP, depending on model
- 150mA output current
- Short circuit & transient spike protected
- Saturation voltage: < 0.3Vdc @ 10mA < 2Vdc @150mA

## INPUT

- Active high (PNP) or active low (NPN), depending on model
- Transient spike protected
- Configurable function: Remote setting or commands, Interrogate, Gate, Dark-On, Lockout, and Latch Reset.

## POWER-UP DELAY

- 300ms. 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)

## MAXIMUM RANGE

(RED) (INFRARED)

### Opposed Mode

- UHS 20in (508mm) 34in (878mm)
- HS 28in (711mm) 48in (1219mm)
- STD 32in (813mm) 57in (1463mm)
- HR 47in (1193mm) 69in (1756mm)
- LR 60in (1524mm) 83in (2121mm)
- ULR 75in (1905mm) 118in (3000mm)

### Proximity Mode

- UHS 8in (203mm) 10in (254mm)
- HS 11in (279mm) 14in (355mm)
- STD 13in (330mm) 15in (381mm)
- HR 16in (406mm) 20in (508mm)
- LR 21in (533mm) 23in (584mm)
- ULR 28in (711mm) 28in (707mm)

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
- Latching function
- Counters (counting range up to 9999)
- Timer range: 0.1 - 0.9ms, 1ms - 9,999ms

## LED 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 - 65,535

## LED INDICATORS

- Output: Red LED. Illuminates when output is ON. Flashes when output is overloaded.
- Connector: Red LED, illuminates when input wire is activated.

## 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

## DFS12 Digital Fiber Optic Sensor

