

FS Series Optional Features Available

Features, Options, and Operational Set-up

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1. Standard Features - Expanded

- 6mm (FS6), 25mm (FS25), and 35mm (FS35) apertures available
- Default closed operation, +5VDC opens the shutter and sustains the device in the open position, 0VDC closes the shutter.
 - For certain applications where the small heat rise in the actuator coil may be an issue, the hold voltage can be decreased to reduce heat rise in the coil, i.e., vacuum applications, etc. Therefore, the shutter will require 5V at 425mA to open and can sustain this voltage indefinitely in ambient. If required, the hold voltage can be reduced to 2.5V at 210mA this reduces the power dissipated within the coil from 2.13W to .53W. Contact Technical Support for additional information and to discuss your specific application.
 - Alternative two stage driver circuits can be recommended.
- Slim, small form-factor
- **RoHS Compliant**
- Operation at +5VDC (open and hold) – Two wire operation, 18-inch flying leads for connection to the actuator coil. Place +5VDC on Red wire, +5V Return on Brown wire – Shutter opens. Remove +5V from the Red wire, shutter closes.

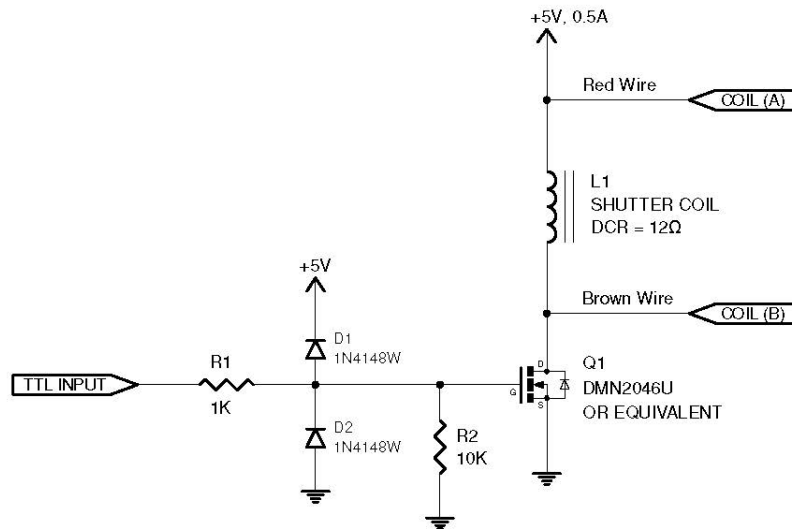


Figure #1 Sample Drive circuit to control the FS Series Shutter from TTL

- To operate the shutter from a TTL signal, Figure #1 illustrates a typical, simple circuit that can be used to open and close the shutter. Active High TTL on the TRIG Input opens the shutter, Low on the TRIG Input closes the Shutter. **The FS Series Shutters will not operate directly from TTL.**
- This circuit is also built into the new **VLM1/VLM1B, TTL Interface Module**. For further information on the VLM1/VLM1B see the following link https://www.uniblitz.com/wp-content/uploads/2021/03/VLM1_VLM1B-User-Manual_1.01_Rev_c.pdf and/or see below within the document – **“VLM1VLM1B Interface Module – For Use with the FS Series”**.
- The FS25 and the FS35 use a “C” type blade [Black carbon impregnated plastic \(C-PET\)](#) shutter blades (5 each) - Blade surface only can handle up to 80°C and laser power up to 50mW/mm².
 - C-Pet is not recommended for laser applications >50mW/mm², however, please contact technical support for your specific laser application. Alternative blade materials and coatings are available. See Optional Features.
- The FS6 uses a “T” Teflon® coated, 0.0015 thick stainless-steel blade. The blade surface can handle up to 200°C and laser power up to 100mW/mm².

- “T” Blades can be used in low power laser applications up to 100mW/mm². However, please contact technical support for your specific laser application. Alternative blade materials and coatings are available. See Optional Features.
- Black anodized aluminum mount (included – Half Housed and (2) half housings included with Full Housed version) provides multiple mounting options – see below for standard mounting methods. Please note - the mount provides a quick method of mounting the shutter into your optical system, it is not required for shutter operation and can be eliminated (purchased without the mount) for OEM applications.
- Half Housed Option
 - FS25S2C0L Mounting Methods – 25mm clear aperture (aperture is reduced to .965 inches – 24.5mm when purchased with half or full housing) due to the max diameter of the C-Mount.
 - Allows 30mm Cage System Extension Rods to be directly attached to 4-40 threaded holes in mount surface.
 - C-Mount Female threaded aperture bore
 - 1/4-20 and M6 threaded holes included for post mounting
 - Provides a flat surface for ease of mounting into an optical system
 - See drawings under the FS25 Specification tab
 - FS6S2T0L Mounting Methods – 6mm clear aperture. This device uses the same mounting methods as the FS25S2C0L.
 - FS35S2C0L Mounting Methods – 35mm clear aperture
 - Can be utilized in a 60mm Cage System. Rods can slide through either half or full housing to allow placement of the shutter to be adjusted or attached with 4-40 threaded holes.
 - T-Mount Female threaded aperture bore
 - 1/4-20 and M6 threaded holes included for post mounting
 - Provides a flat surface for ease of mounting into an optical system
 - See drawings under the FS35 Specification Tab
- Full Housed option:

- FS25S3C0L version – 25mm aperture - A second, identical, aluminum, half housing will be attached to the existing half housing and provide an encapsulated aluminum enclosure for the shutter. See Figure #3.
 - A C-Mount Female threaded aperture bore will be on both sides. Additionally, the housing will now contain (2) each M6 and (2) each 1/4-20 threaded post holes.
- FS6S3T0L version – 6mm aperture – same full housing options as available with the FS25S3C0L.
- FS35S3C0L version – 35mm aperture - A second, identical, aluminum, half housing will be attached to the existing half housing and provide an encapsulated aluminum enclosure for the shutter. See Figure #4.
 - A T-Mount Female threaded aperture bore will be on both sides. Additionally, the housing will now contain (2) each M6 and (2) each 1/4-20 threaded post holes.
- Unhoused
 - The FS6, FS25, and the FS35 are available without the aluminum mount or housing for use in an OEM application (Un-Housed). Due to the configuration of the unhoused device, please contact technical support for mounting considerations. Proper clearances must be maintained from the moving components of the shutter to prevent damage to the shutter or to the user's optical system. Review the data sheet of each device for the unhoused drawings and mounting locations.
- Operating temperature range: -40°C to +65°C

2. Optional Features

- Housing Option selections
 - (Half, Full, and Un-housed) along with the Electronic Sync are options available for purchase through our on-line ordering portal. Additional options may be available, please contact our technical personnel for additional information on availability and purchase.
- Default open configuration (Normally open)
 - All FS shutter types can be manufactured to be in the open position with 0V and close when +5V is applied to the actuator coil.

- Electronic Synchronization
 - The shutter can be equipped with a sensor to sense when the shutter achieves an open (or a closed) position. See a further description of the Sync Circuit under the Specification tab. Sync Operation: As the shutter opens to approximately 80% of full open, the magnet is brought into proximity of Hall Effect (HE) sensor by the mechanical movement of the shutter. This causes the HE sensor to change state and provide a TTL Active High output. Once the shutter moves closed approximately 20%, the sensor again changes state to indicate the shutter is no longer fully open. See shutter schematic and connections illustrated in Figure #2:

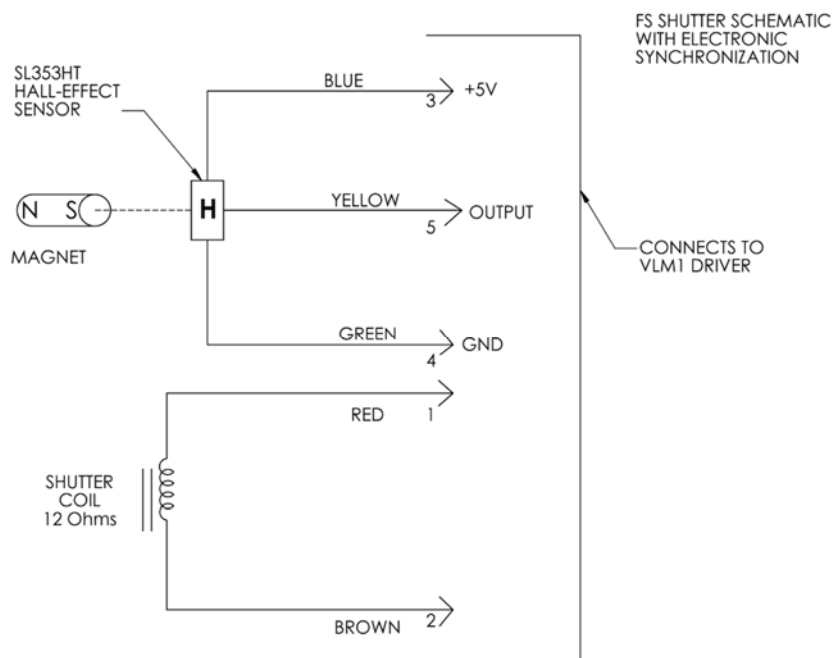


Figure #2 FS Electronic Synchronization Circuit

- Blade Type/Substrate material
 - These materials are available and can be used to increase the damage threshold on the shutter blades. Although these materials and coatings can enhance the blade energy threshold capability, these may tend to slow the response time of the shutter due to the increased mass of the blade(s).
 - Teflon® (T) black coating (Both sides of the aperture) on a 0.001 inch thick Stainless-Steel substrate (laser power up to

100mW/mm²) This is the standard blade of the FS6 device, except the FS6 “T” blade is 0.0015 inches thick.

- AlMgF₂ (ZM) Polished reflective input surface coated with AlMgF₂ (laser power up to 2.5W/mm²). Laser must be input to the reflective surface. Backside of the blades are Teflon (black coated). Contact Technical support for determination of Laser Damage Threshold. All FS types can be equipped with this blade option. The FS6 can also be equipped with AlSiO (Z) blades (laser power up to 5W/mm²).
- Vacuum compatibility up to 10E-10 Torr
 - Shutter will need to be equipped with an EC (Encapsulated Coil), all lubricants and materials used on the standard device will be upgraded to be vacuum compatible. Contact Technical support for additional details.
- +12VDC (Open & Hold)
 - Two wire operation - *Future availability* – A special coil may be available at a future date to allow the user to open and close the shutter with +12V to open and 0V to close. If you have a specific single voltage you require to open and hold the shutter, please contact our technical support staff. We can assist by designing a special coil or by designing an interface circuit to solve your individual application.

3. Mounting Methods

- FS25S2C0L – 25mm Aperture with Standard (Half-Housed or Full-Housed) Mount
 - Allows 30mm Cage System Extension Rods to be directly attached to the shutter using 4-40 threaded holes
 - This device can be fit into 30mm Cage systems from an Optical Component supplier that can provide these Extension Rods to the following specifications:
 - Extension Rods must be equipped with a 4-40 threaded stud, each end, stud length 0.100 inches (2.5mm). The overall diameter must be 0.240 inches (6.0mm).
 - See Figure #5, #6, #7 for Cage System examples under Cage System Mounting Methods below.

- C-Mount Female threaded aperture bore – (1.00"x32TPI) located at the optical center of the assembly.
- 1/4-20 & M6 threaded holes included for post mounting.
- Provides a flat surface for ease of mounting into customer optical system – The optimum configuration is the half-housed version. This configuration offers the best match of cost and versatility. The device can easily be mounted on the flat side of the aluminum half-housing with no interference concerns to the shutter mechanism.
- See Figure #3.
- FS6S3T0L– 6mm aperture – Has the same mounting options (for the half or full housing) that are available with the FS25S3C0L.

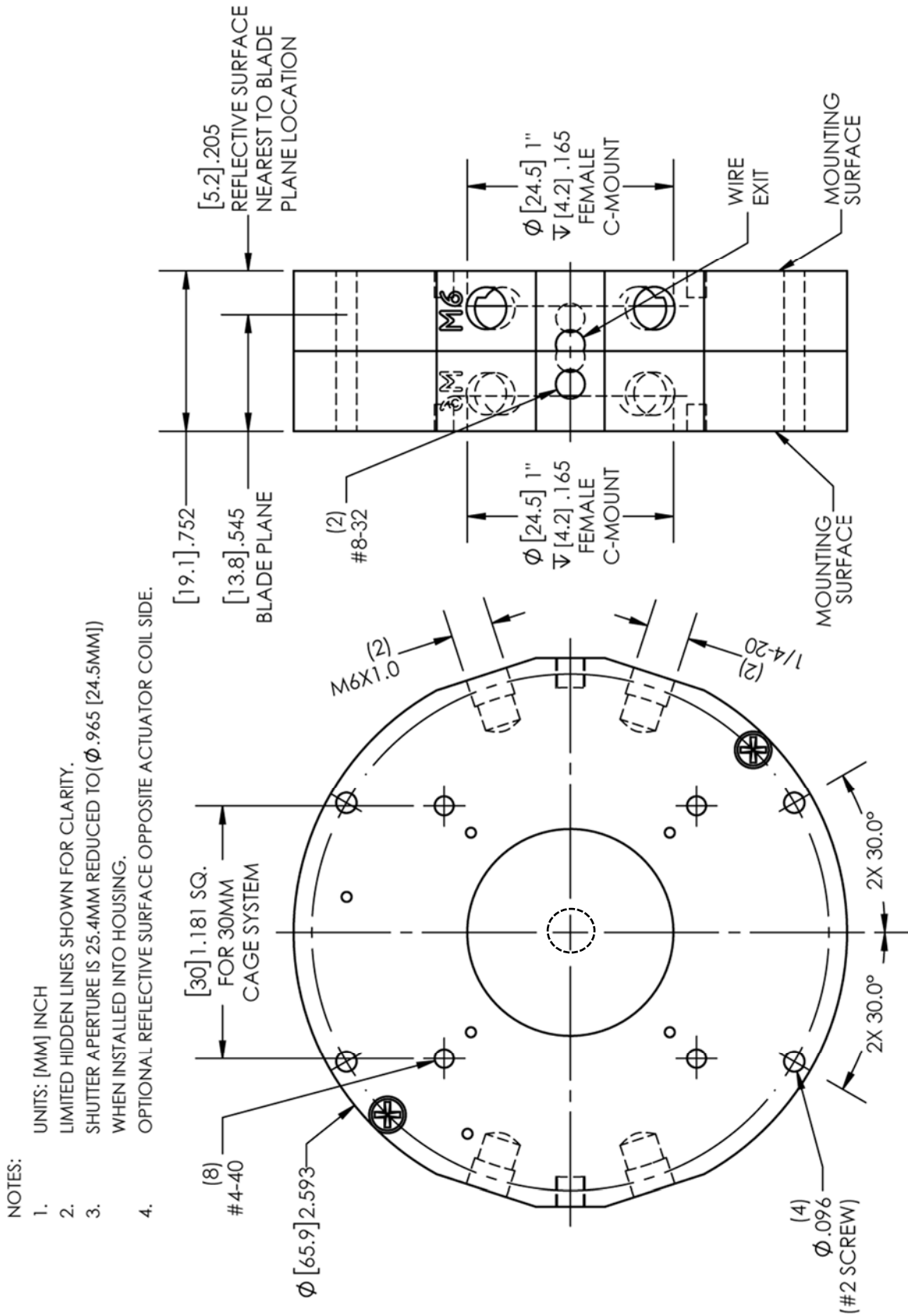


Figure #3 FS6 and FS25 Full-Housed Drawing Showing all Mounting Options

- FS35S2C0L – 35mm Aperture with Standard (Half-Housed or Full-Housed) Mount
 - Allows 60mm Cage System Extension Rods to be directly attached using 4-40 threaded holes or these specified rods can slide through either half or both parts of the Full Housing to allow shutter position to be adjusted along the Extension Rod length.
 - This device can be fit into 60mm Cage systems from an Optical Component supplier that can provide these Extension Rods to the following specifications:
 - Extension Rods must be equipped with a 4-40 threaded stud, each end, stud length 0.100 inches (2.5mm). The overall diameter must be 0.240 inches (6.0mm).
 - See Figure #5, #6, and #7 for Cage System examples under Cage System Mounting Methods below.
 - T-Mount Female threaded aperture bore – M42x0.75 thread – located at the optical center of the assembly.
 - 1/4-20 and M6 threaded holes included for post mounting
 - Provides a flat surface for ease of mounting into customer optical system – The optimum configuration is the half-housed version. This configuration offers the best match of cost and versatility. The device can easily be mounted on the flat side of the aluminum half-housing with no interference concerns to the shutter mechanism.
 - See Figure #4.

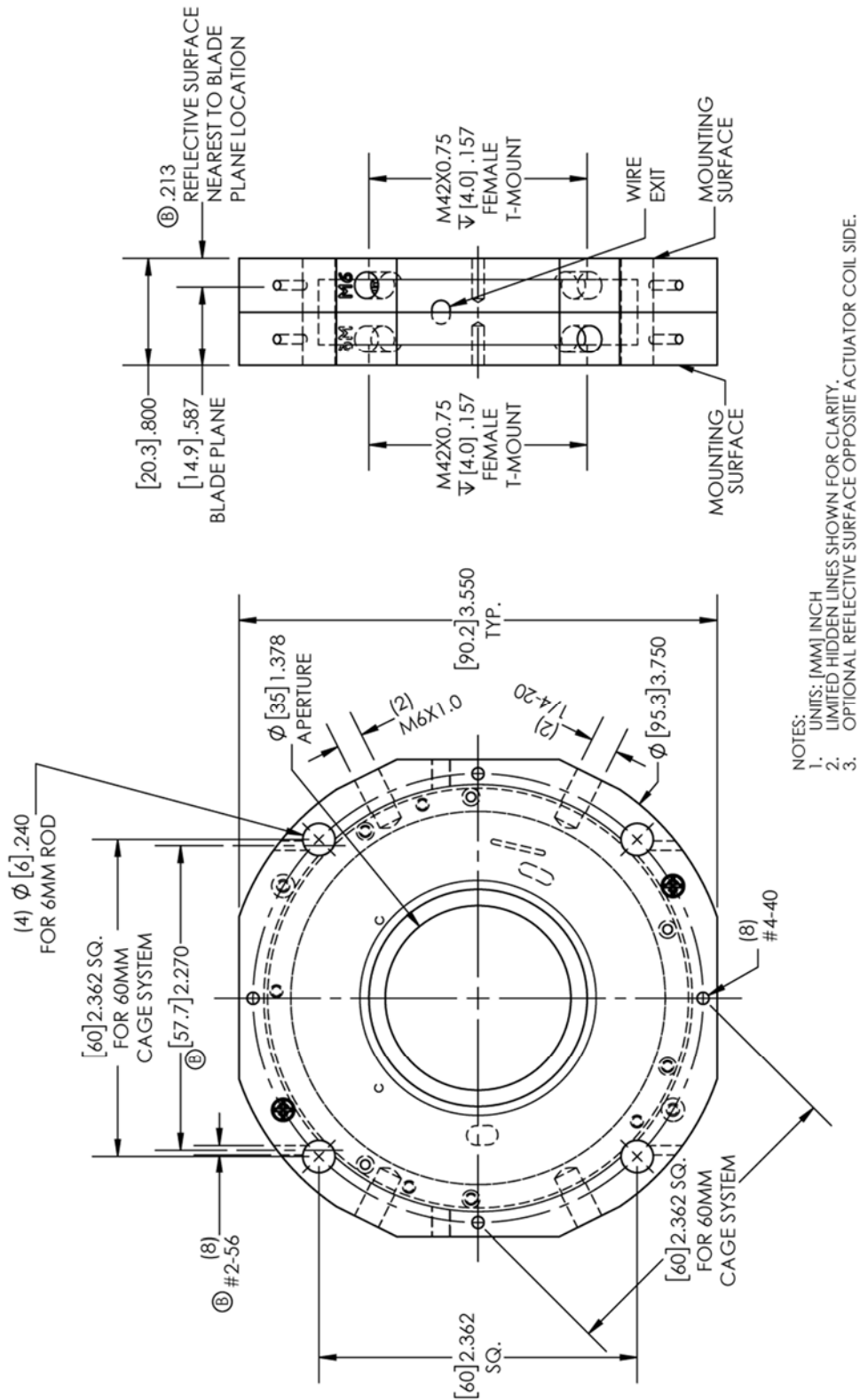


Figure #4 FS35 Full-Housed Drawing Showing all Mounting Options

4. Cage Systems Mounting Methods

- As described above, in addition to post mounting (M6 or 1/4-20) or mounting using the optical thread provided at the aperture center (C Mount – FS6 and FS25 or T Mount – FS35 respectively), the FS Series of devices has the capability to be utilized in an Optical Cage System. These Optical Cage system components (and 6mm cage system rods) are versatile and are available from several Optical Component suppliers. We have designed the FS Series with the ability to be installed into either a 30mm cage system (the FS6 and FS25) or a 60mm cage system (the FS35). By utilizing several readily available components, one could easily install these shutters quickly and accurately into an existing or new Optical System without the need to design and/or fabricate mounts. Below is an example of how the FS6/FS25 and FS35 can be configured with these components.
 - Figure #5 below illustrates how 30mm Cage System Extension Rods are attached (threaded) onto the FS6 or FS25 with a Full-Housed option. This option will allow Extension Rods to be attached to both sides of the shutter.

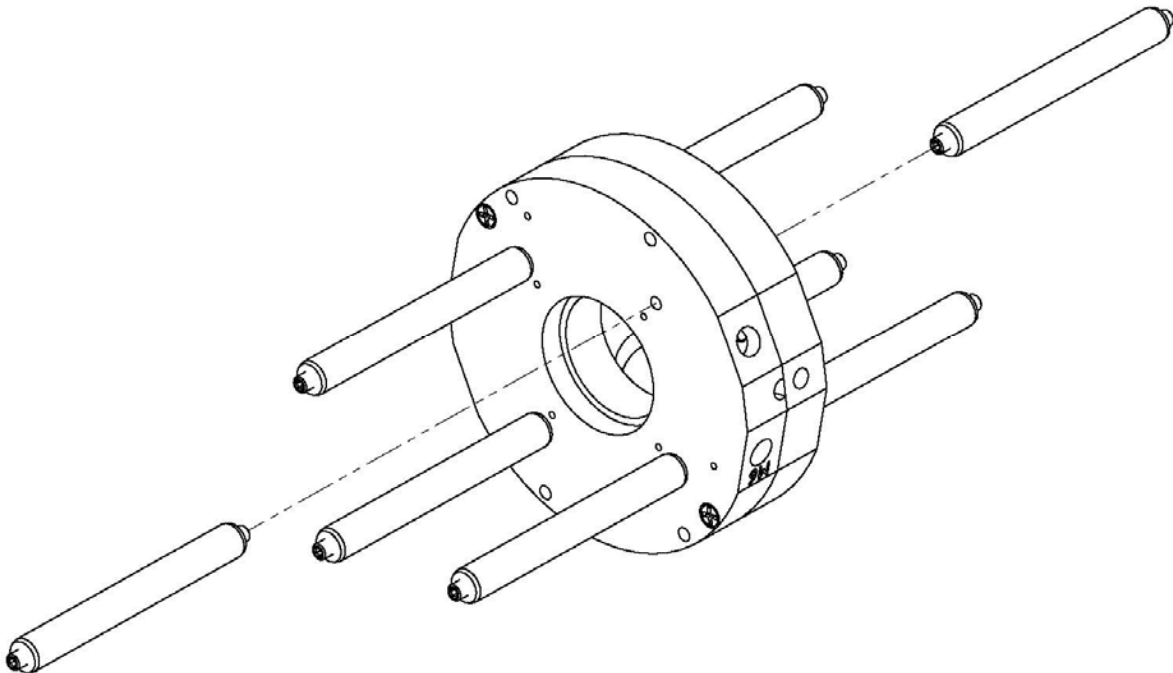


Figure #5 FS6 and FS25 Shown With 30mm Cage System Extension Rods

- Figure #6 below illustrates how 60mm Cage System Extension Rods are attached (threaded) onto the FS35 with a Full-Housed option. This option will allow Extension Rods to be attached to both sides of the shutter.

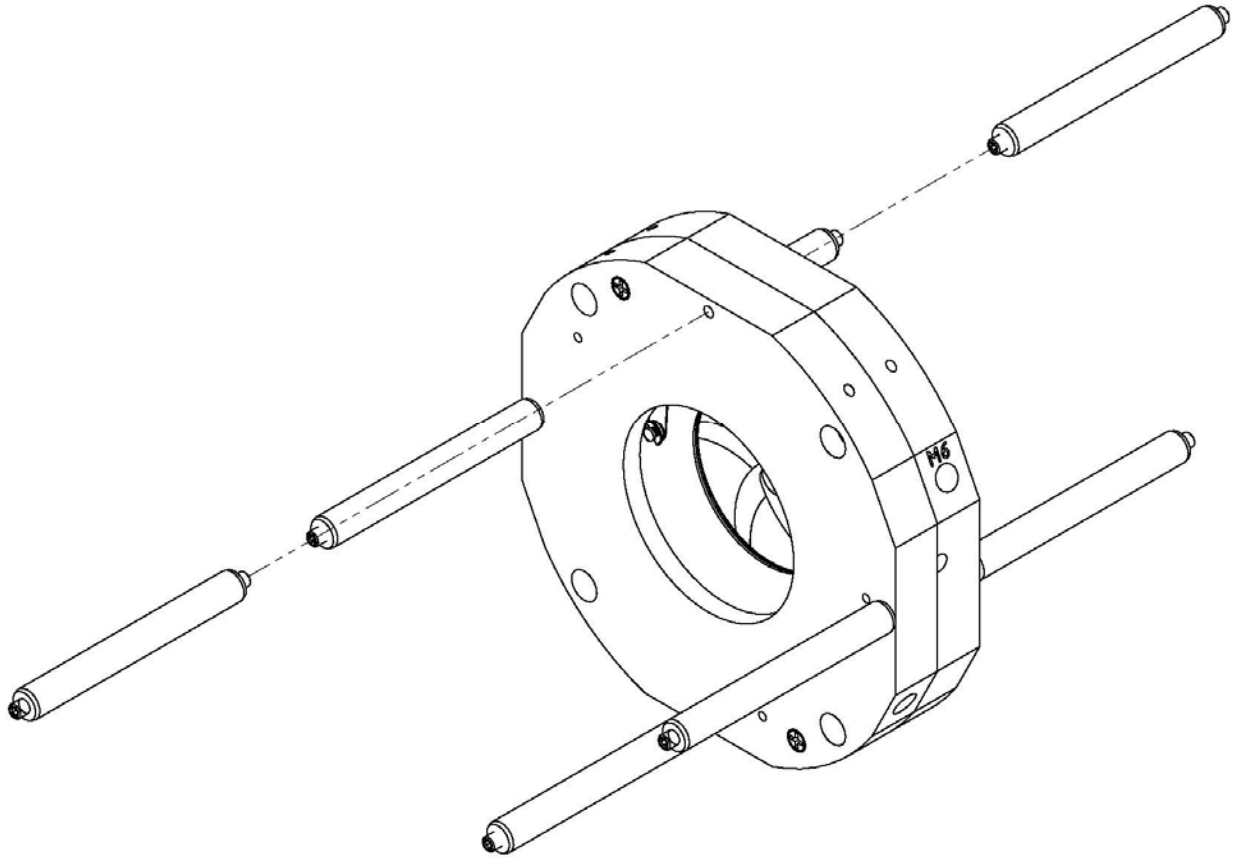


Figure #6 FS35 Shown With 60mm Cage System Extension Rods

- In addition, the FS35 contains (4) 6mm holes into which these same Extension rods can be placed, allowing the shutter to be adjusted along the length of these rods. (Shutter can be moved along the path shown by the arrows). The final position can be secured by tightening the set screw(s) in the housing onto each of the (4) Rods.

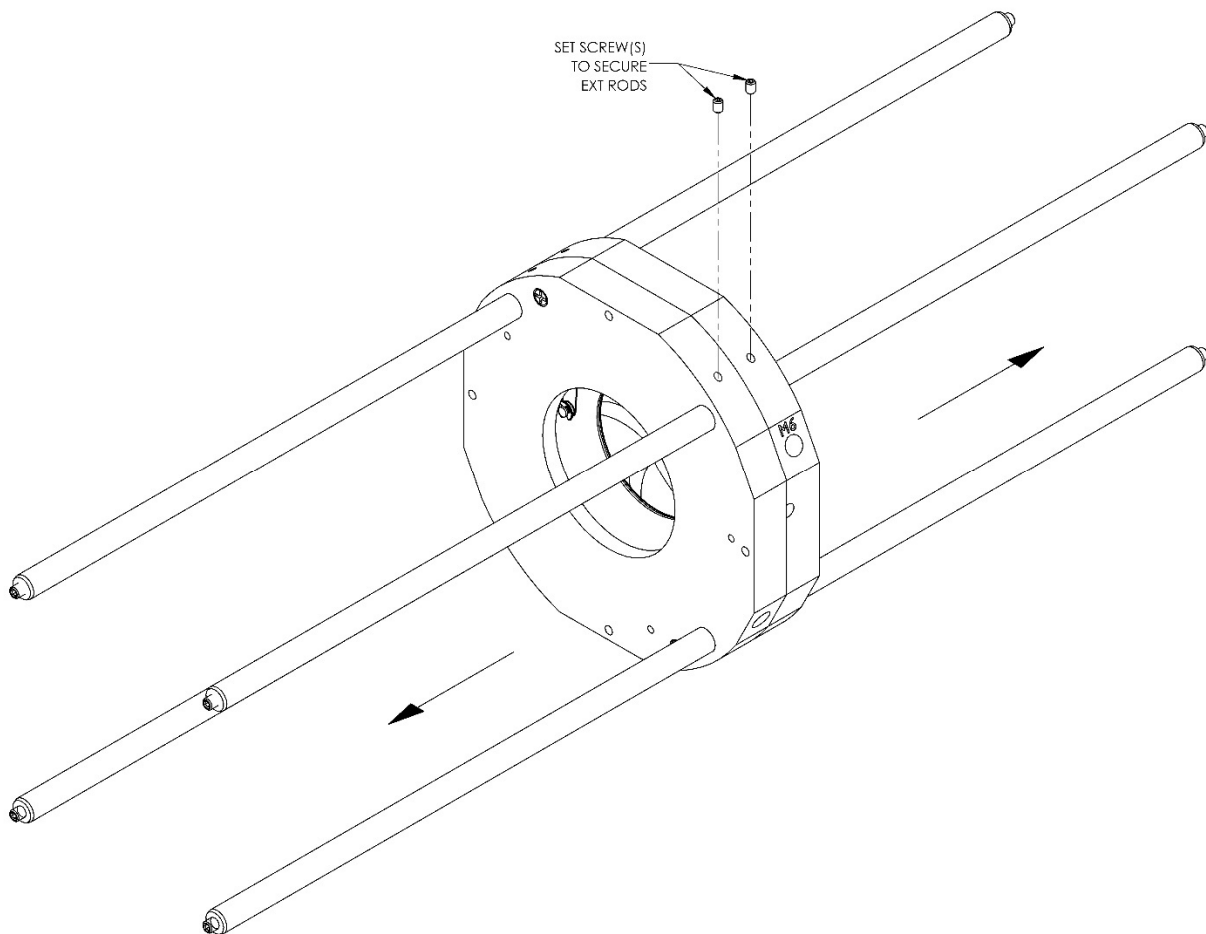


Figure #7 FS35 Shown With 60mm Cage System Extension Rods Inserted into 6mm Holes in the Housing

5. VLM1/VLM1B Interface Module – For Use with the FS Series

- As indicated, the FS Series Shutters do not require a special driver, only +5VDC to open the Shutter and when removing the +5VDC (0VDC) the shutter will return to the close position. However, for those customers that wish to control the FS shutter via a TTL pulse, a computer Serial port, and do not wish to build their own interface, the VLM1/VLM1B Interface Module is available. The VLM1 will allow the user to connect the shutter (equipped with or without an Electronic Sync) and control the shutter manually, via a TTL signal, or via ASCII commands through a computer's USB port. The VLM1 comes equipped with a 5V/1A (5W) power supply that can be connected to the Serial port when a computer is not available for power. A **USB A 2.0 To USB Micro B 2.0** 6 ft (1.83m) cable is included with the VLM1. (The VLM1B includes the PCB only. 5V/1A Power Supply and USB cable can be purchased separately.) See VLM1/VLM1B User Manual at https://www.uniblitz.com/wp-content/uploads/2021/03/VLM1_VLM1B-User-Manual_1.01_Rev_c.pdf
 - Figure #8 below illustrates how to connect an FS shutter to the VLM1 for simple, pushbutton open/close operation. Note, a TTL signal can be input to the PULSE Input BNC to provide Pulse Width Determined Exposure Time control. Additionally, if the shutter is equipped with an Electronic Sync, this can also be interfaced with the VLM1 and the sync signal can be accessed via the SYNC Output BNC. See the Timing Diagram in the FS25 or FS35 Shutter Specification tab. (Connection to the VLM1B shutter connection is the same, except there is no enclosure. In addition, the +5.0VDC Power Supply and the USB Interface Cable are not included.)
 - Operation from a Computer Serial Port can be set up and the protocol is described in further detail within the VLM1 user's manual. When using this feature, power for the shutter will be provided from the Computer's Serial port. The port must be able to provide a minimum of 0.5A for proper shutter operation.

CHKD: STP, 2/2/21
 APPR: DJV, 2/19/21

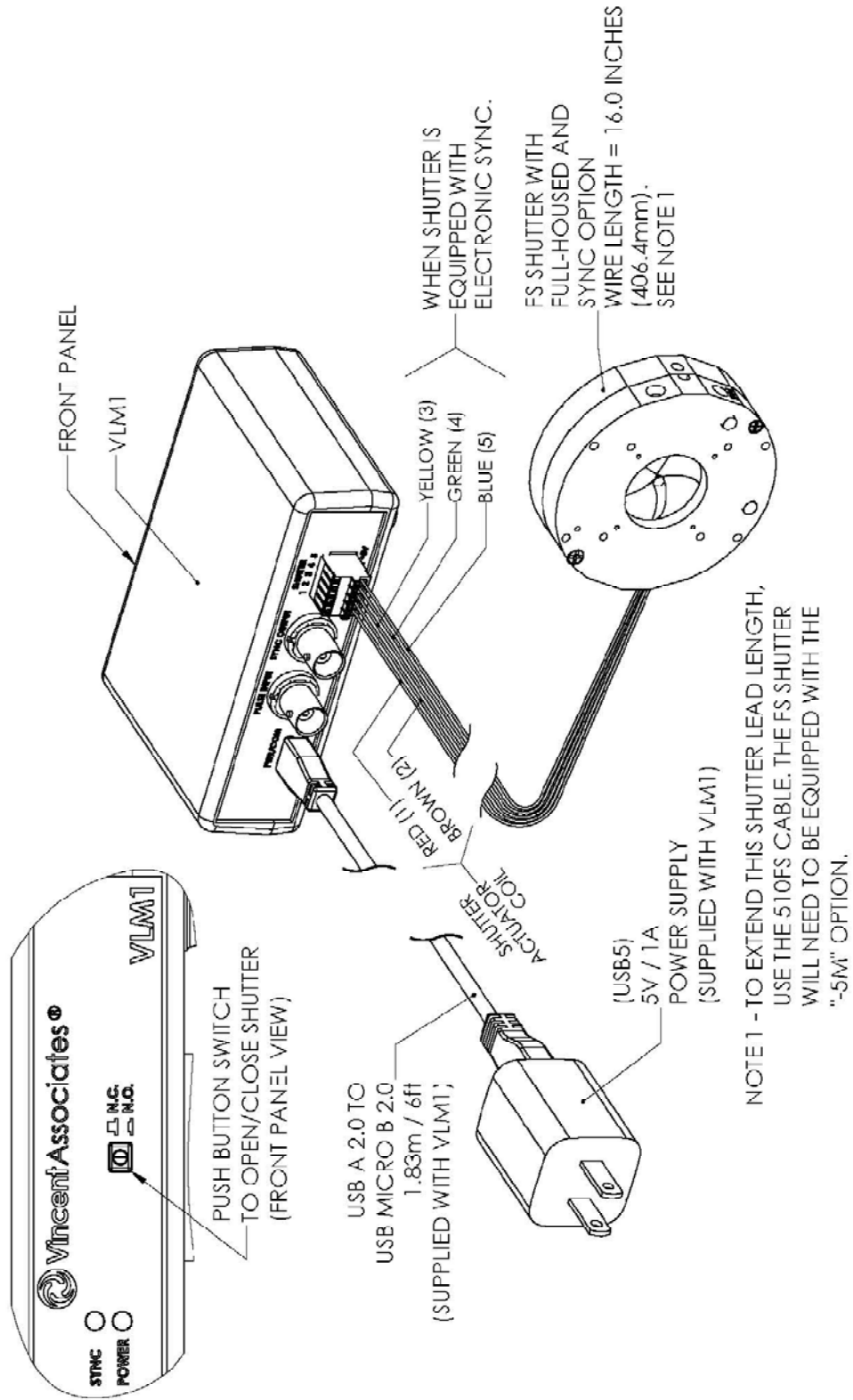


Figure #8 VLM1 to FS Series Shutter Interconnection Diagram

6. Extending the FS Shutter Interconnection

- “-5M” Option
 - For those applications that require an extended interconnect length between the FS Shutter and the VLM1/VLM1B, an optional 6-inch harness and a 5-pin Male in-line connector can be added. This is referred to as the “-5M” option. This connector will then mate with the 5-pin female in-line connector of the 510FS Cable. The 510FS Cable will connect to the VLM1/VLM1B SHUTTER connector in a similar method as the wires from the shutter itself as shown in Figure #8.
 - The 510FS Cable is a 10ft (3m) cable length that has a 5-Pin female in-line connector on one end and a five-wire pigtail on the other. The wire colors coincide with the wires from the shutter and will interconnect shutters that include the electronic sync feature.
 - The drawings that follow, shows an example of the “-5M” optional harness configuration which includes 5-Pin connector termination required for this extension on the FS shutter (Figure #9). Figure #10 shows a drawing of the 510FS cable providing the 3m extension length.
 - The 510FS would connect to the shutter and the pigtail end with connect to the VLM1/VLM1B in a similar fashion as shown in Figure #8.

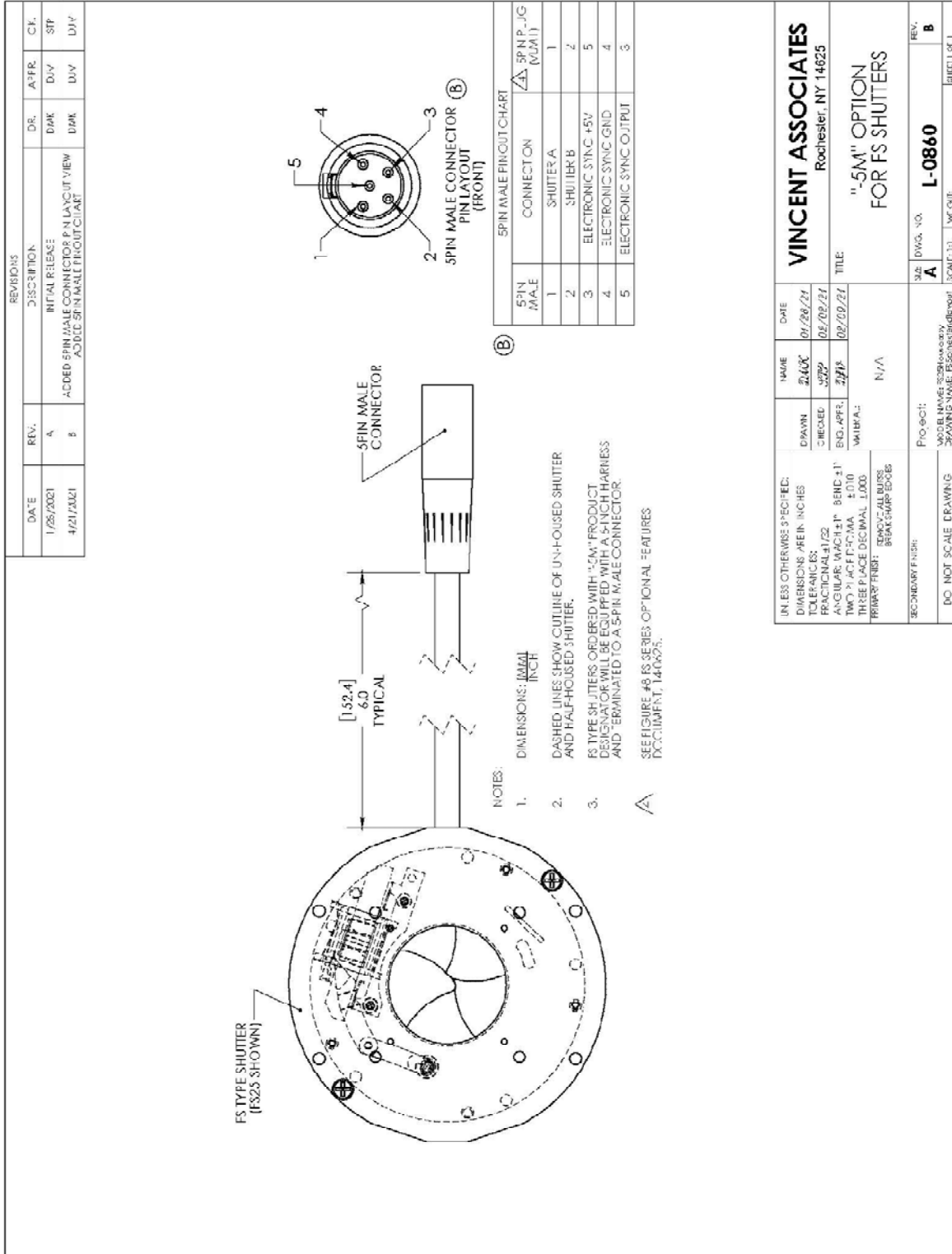


Figure #9 -5M Termination Option for the FS Series (FS25 Shown)

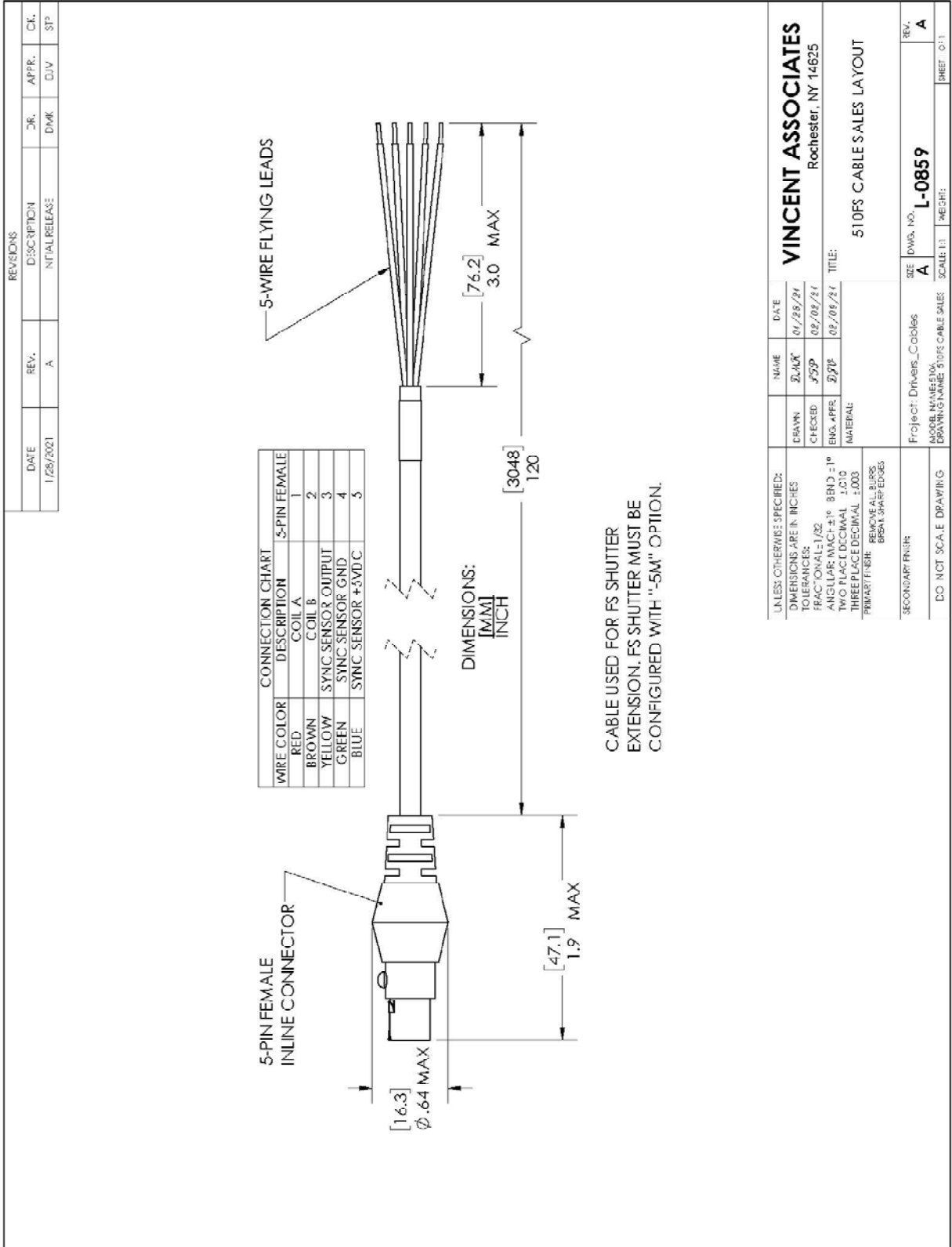


Figure #10 510FS Cable Layout Drawing

7. Faster Shutter Speed for FS Devices

The simplicity of the FS series is provided by operating the device to operate when +5.0V is applied. The timing of this device using +5.0V as the operating voltage can be found on the specific data sheet. However, for applications where increased speed of the FS device utilized is desired, the user can opt to operate these devices from a standard **UNIBLITZ** shutter driver, such as the V880, the VED24, VCM-D1, or other Uni-stable shutter drivers in the **UNIBLITZ** line. See <https://www.uniblitz.com/product-category/shutter-drivers/>. Please contact a technical representative when using a particular driver to insure proper operation of the device. Please note, the Max Frequency of Operation will change and there will be a Burst Mode consideration. Additionally, the lifetime of FS devices is based on operation at +5.0V, when using a standard shutter driver, where the operate voltage will be greater than +5.0V, the lifetime may be reduced. It may also be desirable if faster operation is desired, to return the device to be calibrated with the selected driver.

As an example of shutter speed changes, please review the following information:

Table #1 shows FS6 Timing Comparison between standard +5.0 operation and using the VED24: Table #2 shows FS25 Timing comparison between +5.0V and using the VCM-D1. These value are for reference and actual values my vary.

<u>FS6 Timing</u>		<u>+5.0V</u>	<u>VED24</u>
0-A	Delay time on opening after current is applied	5.2	3.5
A-C	Transfer time on opening	3.3	2.1
0-C	Total opening time	8.5	5.6
C-E	Min. dwell time with min. input pulse	3.7	4.4
B-F	Min. equivalent exp. time	8.4	7.25
D-E	Delay Time on closing after current is removed	2.2	4.0
E-G	Transfer time on closing	6.0	3.3
A-G	Total window time	13.0	9.8
MET	Min. exposure time	10.0	6.0
TEP	Typical exposure pulse	>12.0	>8.0

<u>FS25 Timing</u>		<u>+5.0V</u>	<u>VCM-D1</u>
0-A	Delay time on opening after current is applied	7.0	3.3
A-C	Transfer time on opening	9.0	6.3
0-C	Total opening time	16.0	9.6
C-E	Min. dwell time with min. input pulse	15.0	8.8
B-F	Min. equivalent exp. time	35.0	20.85
D-E	Delay Time on closing after current is removed	1.0	6.4
E-G	Transfer time on closing	22.0	17.8
A-G	Total window time	46.0	32.9
MET	Min. exposure time	30.0	12.0
TEP	Typical exposure pulse	>30.0	>12.0

Revision Table

<u>Date</u>	<u>Auth</u>	<u>Description</u>	<u>Revision</u>
5/11/2023	STP	Update to section #7. Added Burst Mode consideration	Rev c
2/09/2023	STP	Update document to include the FS6 6mm aperture speed increase comparison.	Rev b
5/19/2021	STP	Document was FS Series Application Note #001 New Document #14-0625	Rev a