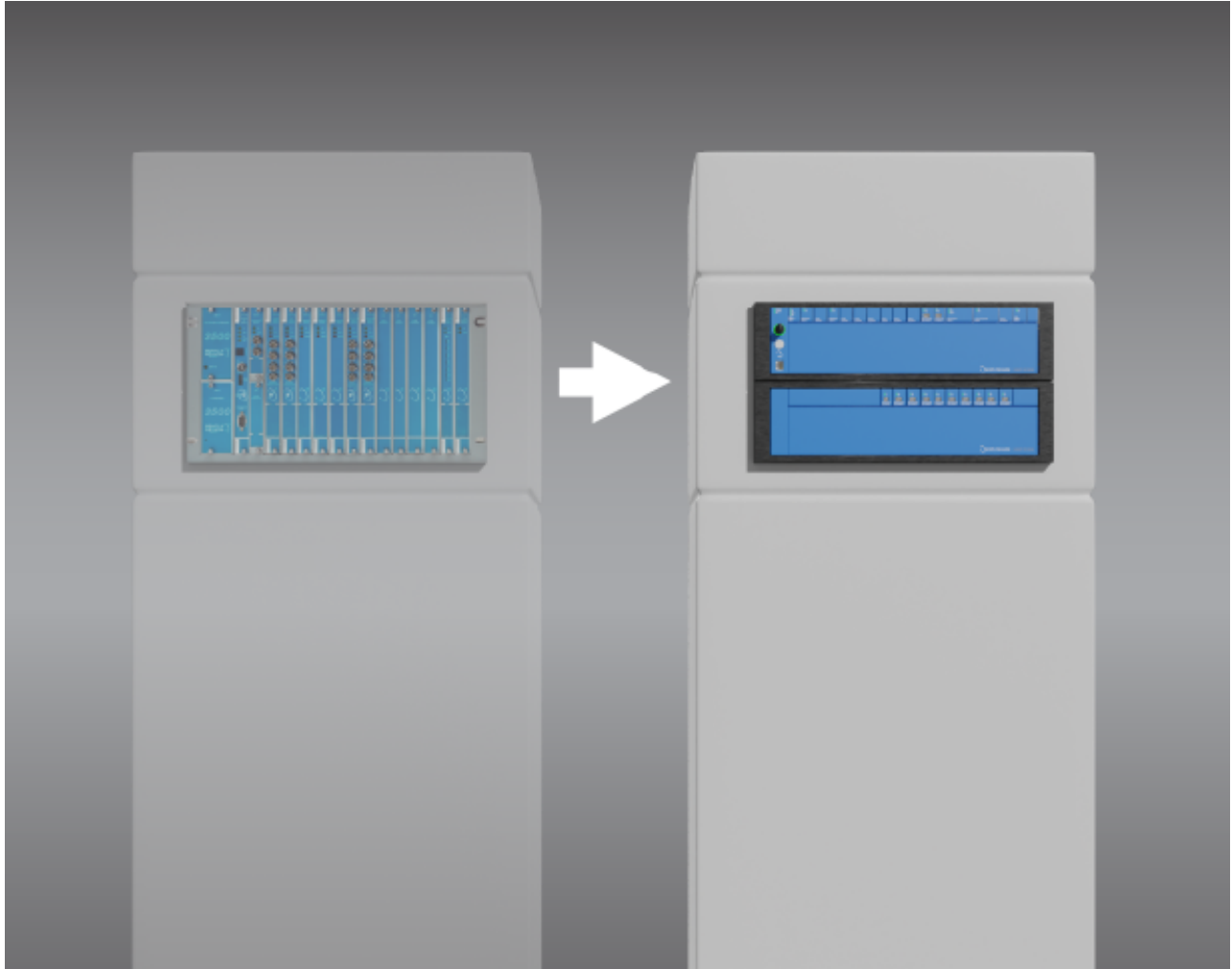




ORBIT 60 SERIES

3500 Retrofit

White Paper

Contents

- 1. Overview 3
- 2. References 3
- 3. Application Considerations 3
- 4. Physical Replacement Options 7
- 5. Orbit 60 Rack-Mount Retrofit Considerations 9
- 6. Orbit 60 Panel-Mount Retrofit Considerations 14
- 7. Orbit 60 Weatherproof Housing (3500/06) Retrofit Considerations 19
- 8. Orbit 60 Bulkhead-Mount Retrofit Considerations 27
- 9. Protection Systems 31
- 10. API 670 Deployments 32
- 11. Hazardous Areas 33
- 12. Field Wiring 34
- 13. Transducers 63
- 14. Glossary of Terms 64

1. Overview

This document provides general recommendations when replacing an existing Bently Nevada™ 3500 monitoring system with an Bently Nevada™ Orbit 60 system, where existing 3500 systems are 19-inch EIA rack mount, panel mount, and bulkhead mount installations. Although this document provides general installation guidelines, each installation is unique and must be evaluated on an individual basis. Replacement of other rack-based systems, such as Bently Nevada 3300, Encore, or competitor systems will be similar, but this document does not describe the specifics of upgrading those systems.

2. References

- Comparison of Orbit 60 Series and 3500 White Paper (142M3829)
- Orbit 60 Relay Modules Datasheet (137M0699)
- Orbit 60 System Overview Datasheet (137M5182)
- Orbit 60 System Module User Guide (142M9080)

3. Application Considerations

Customer Intent

The extent of the rack replacement depends on the customer's retrofit goals. These typically fall into one of the following categories:

1. **Modernization**– The existing 3500 installation meets all of the customer's needs, but the system has exceeded its operational life. For SIL installations, this is the defined mission life of the system. An Orbit 60 retrofit installation should generally match functionality 1:1 with the existing system, and the customer does not need or desire advanced features.
2. **Functionality upgrade**– The current 3500 system does not meet the functional needs of the application (for example, using a 3500 to monitor a REB-based balance of plant equipment). For these applications, the system design is similar to a new application and may include sensors, field wiring, and new functionality as needed.
3. **Capacity addition**– Upgrading that includes adding functionality/sensors or machines into the monitoring system. Orbit 60 installations for these retrofits should align with existing installation parameters.
4. **Controls upgrade**– When upgrading as part of a larger machinery retrofit effort, the Orbit 60 installation can be considered as a new installation. All aspects of the installation, other than rack location can be considered, for example, remote I/O using two bridged chassis system.

Installation Discovery

Addressing the questions below will help ensure a smooth transition during any retrofit installation. Many of these questions will drive the installation scope but will not drive Orbit 60 specific activities. These may include the following (not a complete list):

- Is there a System 1 or TDI secure present?
- Are there any Custom Products modifications to the system?
- What type of Comm Gateway is used?
- Is signal ground tied to the TDI I/O?
- Is any device connected to the BTO Module?
- Is there an earthing module used in the system?
- Are there any triple modular redundant elements in the system?
- Are any multi-mode I/Os used (Hydro or Aeroderivative applications)?
- Are there any unsupported applications utilized for release 1? This would include Hydro, Hyper Recip Compressors, Haz Gas, or Overspeed.

In addition to these general questions, there are differences in Orbit 60 that will drive additional scope or effort to complete the retrofit.

Relays

Which type of relay is right for an application?

Orbit 60 provides two types of relay modules: Electromechanical (EMR) and Solid State Relays (SSR). Refer to the relay Datasheets and User Guide for detailed proper selection and usage. In general it is recommended to use an SSR for dry contact/control system input applications and an EMR for load switching.

If the load cannot be determined, understanding the installed 3500 module will yield a reasonable guess. Any application connected to a load (an interposing relay, indicator light, for example) should use an Orbit 60 electromechanical relay (EMR). Any 3500 installations connected to a digital input of another system or installed using the gold-plated relay module modification, 3500/33-03, or 3500/33-04 should use an Orbit 60 solid state relay (SSR).

Recorder Outputs

How many recorder outputs from the 3500 system are used?

Orbit 60 input modules do not provide analog recorder output signals. If analog output signals are required for the retrofit, dedicated Recorder Output Modules must be included in the Orbit 60 system, with each card supporting eight output channels. Ensure that the Recorder Output modules are accounted for in the chassis slot count.



Carefully consider the placement of the Recorder Output Modules within the Orbit 60 chassis, in order to closely match the existing 3500 recorder output wiring connection points.

DC LVDTs

Does the existing 3500 system include DC LVDT transducers?

The Orbit 60 PAD module transducer's power for DC LVDTs is -24 Volts, which is greater than the -15 V transducer voltage supplied by 3500/45 Position monitors. Because of this, retrofitting 3500/45 with the Orbit 60 PAD module will increase the Scale Factor and likely shift the Zero Position of the sensor.

Therefore, at the same time the monitor is being replaced, it is necessary to re-commission the DC LVDT sensor with a cold shaft, resetting the voltages for the Upscale and Downscale sensor positions.

Additionally, it is required to replace older DC LVDTs which require more power than the Orbit 60 PAD modules can supply to the Transducers. The Orbit 60 PAD module is fully compatible with Bently Nevada's current offering of DC LVDTs.

External Termination Blocks

Does the existing 3500 system use external termination blocks?

If yes, see [3500 External Terminations on page 34](#).

Internal Barriers

Does the existing 3500 system include internal barrier I/O modules?

If yes, see [Hazardous Areas on page 33](#).

Hazardous Area Implementation

Does the existing installation involve hazardous area certifications?

The scheme used to meet the installation criteria must be understood, nL, nA, Ic, Ec. See [Hazardous Areas on page 33](#) for details.

Power Supply Availability

Unlike 3500, Orbit 60 uses commercial, off-the-shelf, 24 V power supplies. For retrofit applications, use redundant power supplies with a minimum of 400 Watts each for single 6U chassis, and with a minimum of 200 Watts each for single 3U chassis. Power supplies are available as part of the Orbit 60 Series options:

Table 1: Power Supply Options

240W Power Supply for 3U chassis	
60X/XPS01	with options for: • Country-specific codes
480W Power Supply for 6U chassis	
60X/XPS02	with options for: • Country-specific codes

Display

Does the existing installation utilize a Bently provided display?

Unlike the 3500, an Orbit 60 display does not take up a slot in the chassis, but utilizes an external DIN rail-mounted industrial PC to drive the display. If a display is shared by multiple 3500 systems and all 3500s are being replaced, only one display and CPU module needs to be installed.



While an Orbit 60 display can be connected to multiple Orbit 60 systems, it cannot support a mix of 3500 and Orbit 60 systems.

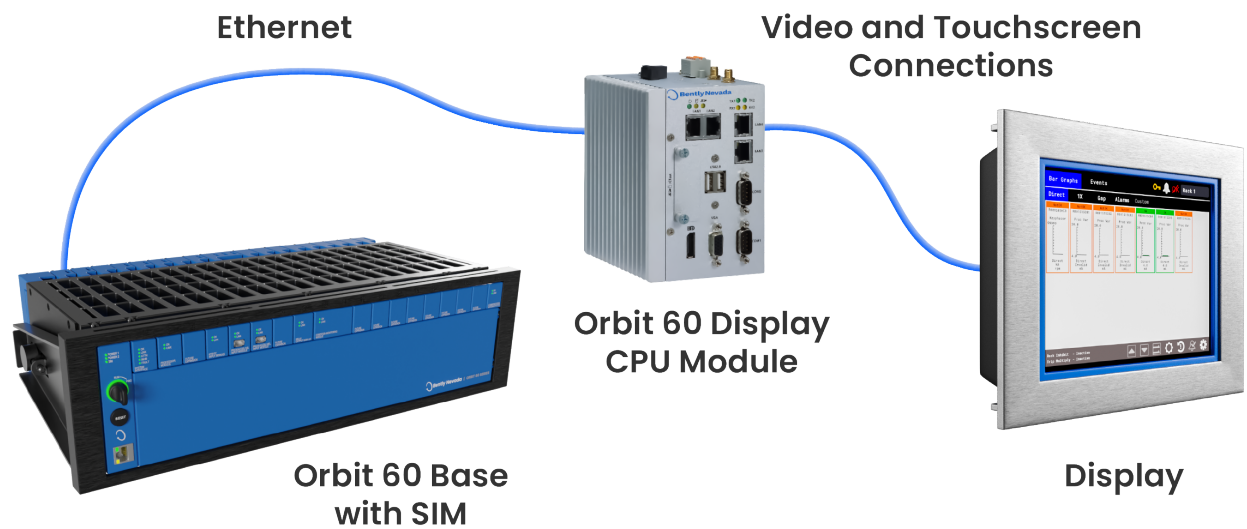


Figure 1: Orbit 60 Display Connection

4. Physical Replacement Options

3500 replacements should generally use a 6U x 19-inch Orbit 60 Chassis. Smaller point count 3500 applications may be able to use a 3U x 19-inch chassis from a point count and capacity perspective. However, Bently Nevada's recommendation is to generally use the 6U base when possible to fill in the panel/cabinet space and use the integral mounting of power supplies.



6U, 28-Slot
(Bulkhead, Rack, or Panel Mount)



3U, 19-Slot
(Bulkhead, Rack, or Panel Mount)

Figure 2: 6U and 3U Slot Orbit 60 Chassis Options

Orbit 60 3U and 6U Chassis Selection

When considering selecting either an Orbit 60 3U or 6U chassis to retrofit an existing 3500 chassis, here is a summarized recommendation, followed by a table which includes a more detailed list of important differences and potential advantages for selecting between the larger or smaller form-factors.

Generally, choose a 6U chassis when:

- The 6U integral power supply mounting is preferred or needed.
- Additional monitoring capacity is needed.

Generally, choose a 3U chassis when:

- The 3U monitoring capacity is adequate (including future expansion).
- The installation area has an appropriate DIN-rail location to mount the Power Supplies and external display PC (if desired).

Table 2: Comparing 6U and 3U Options

Category	Advantages and Cautions of Selecting a 6U Chassis	Advantages and Cautions of Selecting a 3U Chassis
Monitoring Capacity	28 total monitoring slots	19 total monitoring slots
Chassis Size (Envelope)	Care must be taken with a 6U replacement since Orbit 60 chassis requires 3 inch (75 cm) ventilation clearance keep-out distances instead of the 3500's 2 inch (50 cm) required ventilation clearance.	The smaller size allows additional clearance between the Orbit 60 and any other existing equipment. (Note: Two 3U Orbit chassis may not be used to replace an existing 3500 in the same location, since this won't provide the necessary ventilation clearances between both 3U chassis.)
Power Supply Mounting	Chassis includes mounting method for the power supplies, protruding behind the 6U chassis.	Means of Power Supply mounting must be provided by the user.
Rack-mount Cabinet Installation	The 6U Orbit 60 chassis will fit directly into the existing space of the existing 3500 rack.	An optional retrofit accessory kit with cabinet blanking plates and mounting hardware is available to fill the differences in chassis sizes.
Panel-Mount Cutout Size	The 6U chassis will replace directly into the existing 3500 opening.	In the future an adapter-plate accessory can be ordered to interface between an existing 3500 opening and the 3U chassis.

Panel Mount

The Orbit 60 6U x 19-inch chassis is designed to fit directly into the space used by a 3500 panel mount system. However, it is important to refer to the System Module User Guide's (document 142M9080) recommended panel cutout size. The 60R/CHA05-XXX-X chassis provides the necessary mounting fixtures to support the system within a panel mount cutout.

19-inch EIA Rack Mount

For rack mount installations, the Orbit 60 6Ux19-inch rack fits directly into the same space as the 3500 system. A 60R/CHA04-XXX-X chassis can retrofit a rack-mounted 3500 installation. This ordering option contains all the necessary items to rack mount the Orbit 60 system. Additional information regarding retrofits with a 3U chassis is provided below.

Bulkhead Mount

The 3500-bulkhead installation uses a 12U space when installed. The Orbit 60 system only uses 6U. Other components such as barriers, isolators, or a display computer can occupy the additional space. Bulkhead installations use part number 60R/CHA06-XXX-X and include the mounting hardware necessary for bulkhead mounting of the system.

5. Orbit 60 Rack-Mount Retrofit Considerations

6U Rack-Mount Retrofit Considerations

An Orbit 60 6U rack-mount system can directly replace a 3500 rack-mount system. Because both systems have a height of 6U, they will occupy the same amount of space on a 19 inch rail. No retrofit kit is needed.

It is important to note that the Orbit 60 6U system has a 3 inch (75 mm) ventilation spacing requirement above and below the chassis compared to the 3500 2 inch (50 mm) ventilation spacing requirement. It is assumed that most 3500 rack-mount installations provide 2U (3.5 inches) of spacing between the system and adjacent hardware.

3U Rack-Mount Retrofit Considerations

A rack-mount retrofit kit (part number 60X/RFT01) is offered to simplify the replacement of a 3500 rack-mount chassis with a 3U Orbit 60 chassis.

Rack-Mount Installation

The 3U rack-mount retrofit kit contains a larger (2U) blanking panel and a smaller (1U) blanking panel. There is no requirement for positioning of either panel, as long as one panel is installed above the Orbit 60 System, and the other is installed below. Mounting in this configuration helps ensure ventilation requirements are met.

Snap-in nuts, mounting screws, and blanking panels are provided with the retrofit kit. Bezel and system mounting brackets are provided with the Orbit 60 system.

Table 3: 60X/RFT01 Retrofit Kit: Rack Mount Components

BN Part Number	Description	Quantity
172231	1U Blanking Panel	1
172232	2U Blanking Panel	1
2298071	M6 nut	14
179355	M6 screw	14

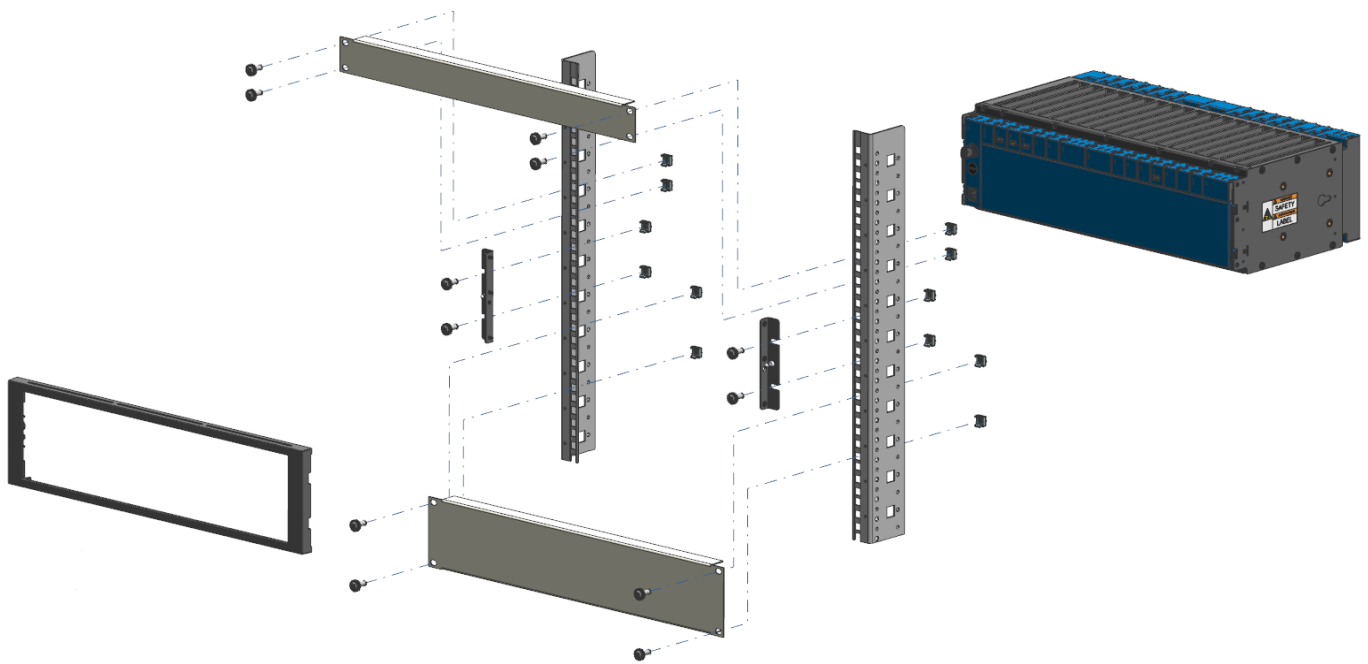


Figure 3: Rack-Mount Retrofit Kit



The system mounting brackets supplied with the Orbit 60 system are shown installed separately since these must be attached after the Orbit 60 chassis is inserted from the rear of the cabinet to fit through the cabinet's mounting rails. A 2-person team is recommended for lifting, supporting, and securing the Orbit 60 (one working at the front and the other at the rear of the cabinet.) One of the kit's blanking panels may be used to temporarily support the Orbit 60 chassis while the bracket is fastened to the chassis. Then the chassis should be positioned appropriately as it is secured to the cabinet rails.

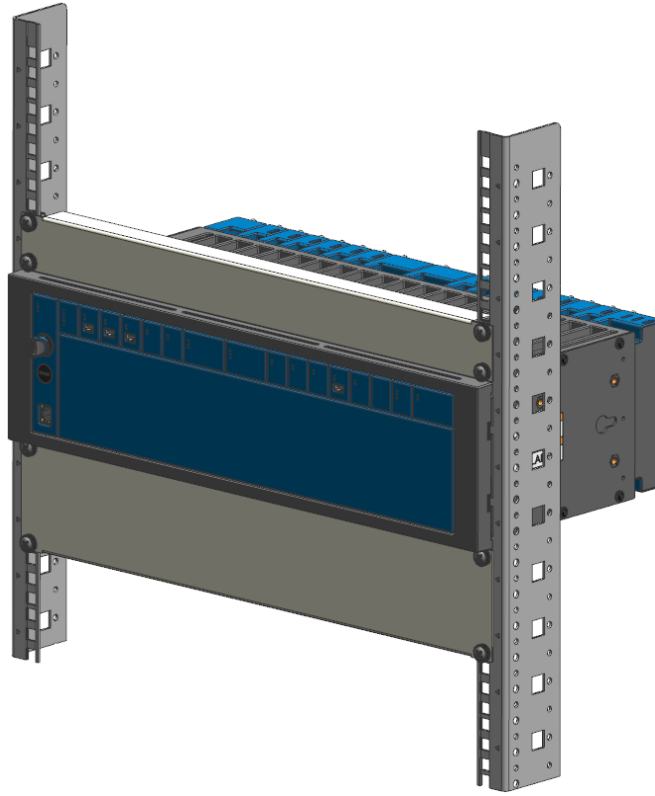


Figure 4: Retrofit Kit Mounting

Ventilation Spacing

To meet ventilation spacing requirements for the Orbit 60 system, there should be no hardware mounted on the 19 inch rail directly adjacent to the smaller (1U) blanking panel (except other blanking panels).

The blanking panels provided with the retrofit kit were selected so that once installed in the cabinet with the 3U Orbit 60 system, there would be no "gaps" left behind by the previously installed 3500. The blanking panels are not meant to ensure ventilation requirements are met; this must be verified. If the existing 3500 system installation met the recommended 2 inch (50 mm) ventilation spacing above and below the 3500 chassis, then there will be ample ventilation spacing for the 3U Orbit 60 retrofit.

If the existing 3500 installation did not meet 3500 ventilation requirements, then it may be necessary to strategically position the larger blanking panel between the 3U Orbit 60 system and other hardware, or the other hardware may have to be moved so that the necessary ventilation clearance of 3 inches (75 mm) above and below the Orbit 60 chassis is maintained. (Orbit 60 ventilation spacing requirements are described in more detail in the *System Module User Guide* [document 142M9080].)



The blanking panels are not to be used for mounting of any hardware.

Power Supply and External Display PC Installation for Rack-Mount Chassis

The following additional instructions and tips provide reminders and additional retrofit background, but please refer to the standard installation details provided in the *System Module User Guide*

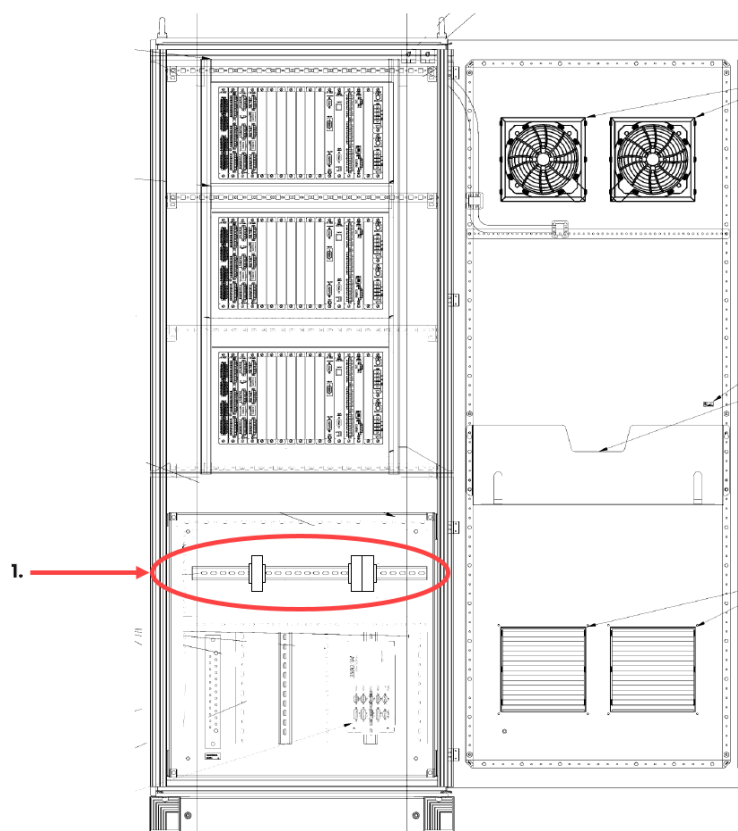
(document 142M9080) general installation instructions.

The 3500 Power Input Modules (PIMs) had a variety of models to accommodate a range of AC and DC power sources. However, the Orbit 60 PIMs only work with a low voltage DC supply. Therefore, the location and installation of AC/DC power supplies is an important retrofit consideration. These detailed considerations include satisfying the necessary ventilation keep-out clearances above and below the power supplies. Also note that the power supplies must be installed on horizontal DIN rail to meet the power supply temperature specifications, and independent redundant power supplies are always recommended.



Ensure that DC power supplies or External display PC are not installed within the ventilation clearance zone of the Orbit 60 chassis. See *System Module User Guide* (document 142M9080).

For cabinets with multiple systems installed, it may be difficult to find available room to install the power supplies. Orbit 60 6U systems include a DIN-rail for attaching power supplies behind the chassis, as long as sufficient depth is available. When a 3U Orbit chassis will be used within a cabinet, it is generally recommended to install the necessary power supplies and a display PC (if desired) on an available existing horizontal DIN-rail (typically near the bottom of the cabinet where existing cabinet power supplies and circuit breakers may be installed).



1. Preferred power supply location using existing horizontal DIN-rail.

Figure 5: Preferred Power Supply Location

If existing horizontal DIN-rail is not available within the cabinet, then additional DIN-rail may be installed in an appropriate location elsewhere within the cabinet. It is important to maintain

ventilation keep-out clearances above and below the Orbit 60 chassis, the power supplies, or any other equipment within the cabinet. Note that the power supply's required ventilation keep-out clearance is 2.0 inches (50 mm) above and below the units.



Ensure that power supplies and the high voltage power supply wiring must maintain proper separation distance from signal wiring.

Power Supply Wiring Connections

Orbit 60 PIMs utilize spring-loaded connections. Therefore, ferruled wires are recommended for the wiring from the DC power supplies. Refer to *System Module User Guide (document 142M9080)* for supported wiring sizes and installation recommendations.



Wiring sizing requirements must comply with local electrical codes.

Also note that the ground wiring layout differs from the 3500's grounding method which used a switch on the Power Input Module to toggle a connection between common and earth ground. Orbit 60 has both a signal ground and earth ground connection which can be connected separately for Intrinsically safe or other applications. Otherwise, the I.S. and P.E. points should be connected together and grounded.

6. Orbit 60 Panel-Mount Retrofit Considerations

6U Panel-Mount Retrofit Considerations

An Orbit 60 6U panel-mount system can directly replace a 3500 panel-mount system. The 6U Orbit 60 is designed to fit in the existing 3500 panel cutout opening. No retrofit kit is needed.

6U Panel-Mount Installation Overview

1. Remove the existing 3500 system.
2. Remove the Orbit 60 front bezel.
3. Remove the Orbit 60 front chassis mounting brackets via the six 6-32 screws.
4. Slide the Orbit 60 system through the back of the cutout opening.
5. Re-install and secure the Orbit 60 front chassis mounting brackets with the six 6-32 screws.
6. Install and secure the Orbit 60 panel mount clamps.
7. Re-install the Orbit 60 front bezel.



The Orbit 60 6U system has a 3 inch (75 mm) ventilation spacing requirement above and below the chassis compared to the 3500 2 inch (50 mm) ventilation spacing requirement. The Orbit 60 panel mounting brackets can accommodate a maximum panel thickness of 0.19 inches (4.8 mm). Order a standard Orbit 60 6U with panel mount chassis.

3U Panel-Mount Retrofit Components

A panel-mount retrofit kit is offered to simplify the replacement of a 3500 panel-mount chassis with a 3U Orbit 60 chassis. Due to the smaller overall height of the 3U Orbit 60 chassis compared to the 3500 chassis, a filler panel is required to cover the larger 3500 panel cutout opening and accommodate the mounting of the 3U Orbit 60. Assuming the existing 3500 panel cutout is within Bently Nevada published dimensional specifications, no additional holes or modifications to the existing 3500 panel cutout are required. The 3U panel-mount retrofit kit is available in powder coated steel (60X/RFT02) or stainless steel (60X/RFT03) versions.

Table 4: 60X/RFT02 Retrofit Kit Components

BN Part Number	Description	Quantity
183M5572-01	Filler Panel (Steel)	1
184M2617-01	Clamp Bracket (Stainless Steel)	2
04281412	#10 Flat Washer (Stainless Steel)	6
04375104	10-32 Lock Nut (Stainless Steel)	6

BN Part Number	Description	Quantity
04281414	¼ Inch Flat Washer (Stainless Steel)	10
184M7872	¼-20 Inch Lock Nut	10



Two extra #10 flat washers, 10-32 lock nuts, ¼ inch flat washers, and ¼-20 lock nuts are provided with the 60X/RFT02 kit.

Table 5: 60X/RFT03 Retrofit Kit Components

BN Part Number	Description	Quantity
183M5572-02	Filler Panel (Stainless Steel)	1
184M2617-01	Clamp Bracket (Stainless Steel)	2
04281412	#10 Flat Washer (Stainless Steel)	6
04375104	10-32 Lock Nut (Stainless Steel)	6
04281414	¼ Inch Flat Washer (Stainless Steel)	10
184M7872	¼-20 Inch Lock Nut	10



Two extra #10 flat washers, 10-32 lock nuts, ¼ inch flat washers, and ¼-20 lock nuts are provided with the 60X/RFT03 kit.

3U Panel-Mount Installation Overview

1. Remove the existing 3500 system.
2. Remove the Orbit 60 front bezel.
3. Remove the Orbit 60 front chassis mounting brackets via the six 6-32 screws.
4. Slide the retrofit filler panel over the front of the Orbit 60 chassis.
5. Re-install and secure the Orbit 60 front chassis mounting brackets with the six 6-32 screws.
6. Secure the Orbit 60 chassis to the retrofit filler panel via the four 10-32 rack mount studs using the provided #10 washers and 10-32 locking nuts.
7. Slide the Orbit 60 chassis and retrofit filler panel through the front of the cutout opening.
8. Secure the retrofit filler panel in the cutout opening with the retrofit clamp bracket using the provided ¼ inch washers and ¼-20 locking nuts via the retrofit filler panel ¼-20 studs.
9. Re-install the Orbit 60 front bezel.



This panel-mount retrofit kit is designed for the Orbit 60 3U **rack-mount chassis**, but this retrofit kit will also accommodate a 3U panel-mount chassis.

Panel-Mount Installation

The 3U panel-mount retrofit kit utilizes a 11.9 inch x 19.8 inch filler panel (qty 1), stainless clamp brackets (qty 2), #10 stainless steel flat washers (qty 4), 10-32 stainless steel locking nuts (qty 4), ¼ inch stainless steel flat washers (qty 8), and ¼-20 stainless steel locking nuts (qty 8). The filler panel has 10-32 and ¼-20 studs to rack-mount the Orbit 60 chassis to the filler panel and clamp the filler panel to the existing 3500 panel cutout. (These front studs will not be used if a 3U chassis with panel-mount brackets is utilized.)

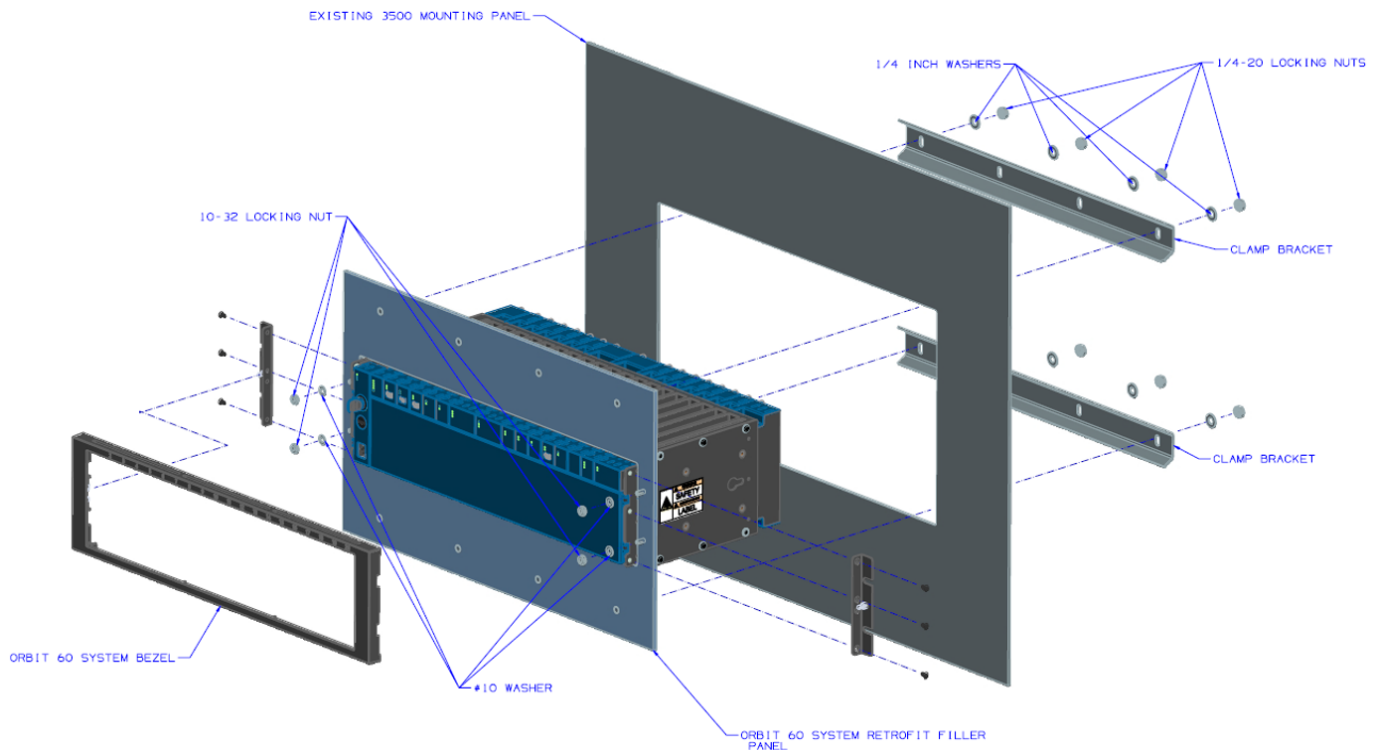


Figure 6: Panel-Mount Retrofit Kit Assembly (See Drawing 184M4900)



The clamp brackets include markings indicating the correct orientation to ensure the longer leg of the bracket faces the Orbit 60 3U chassis. When installed correctly, the Orbit 60 panel-mount retrofit kit clamps can accommodate an existing 3500 panel cutout maximum thickness of 0.25 inches (6.4 mm).



The Orbit 60 chassis mounting brackets that are supplied with the Orbit 60 system must be removed to mount the filler panel to the Orbit 60 chassis and then reinstalled. A 2-person team is recommended for lifting, supporting, and securing the Orbit 60 chassis and filler panel into the existing 3500 panel cutout using supplied clamp brackets.

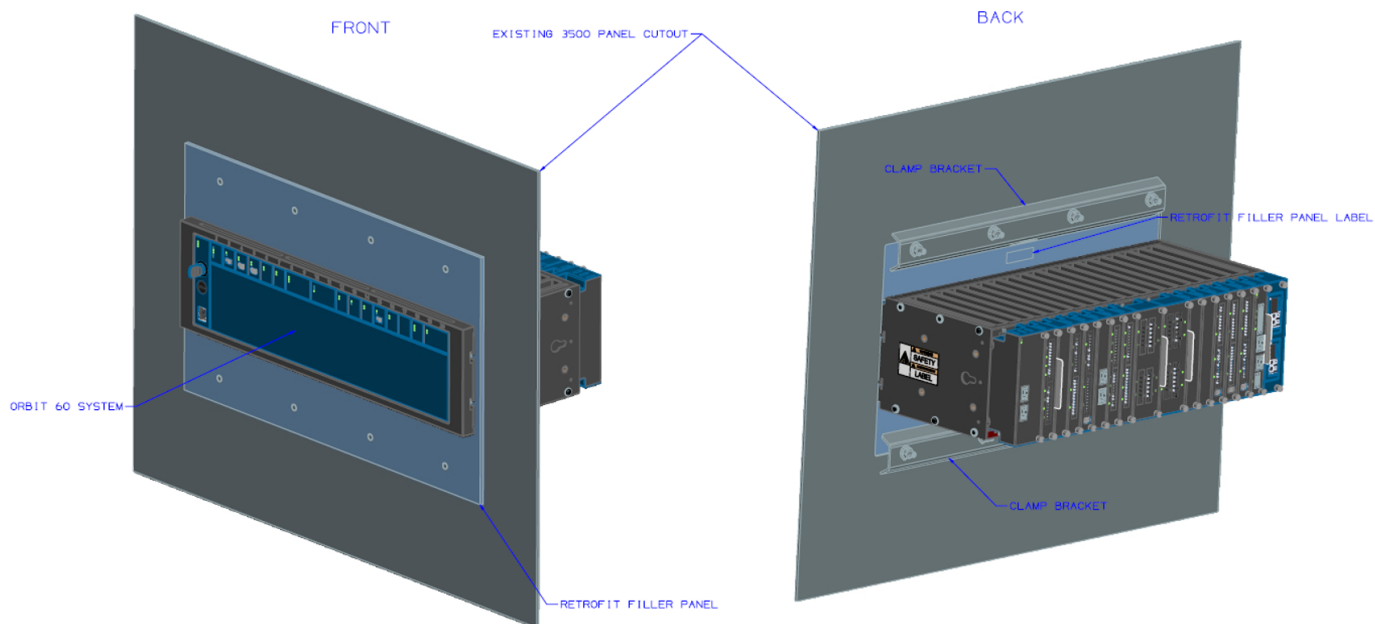


Figure 7: Assembled Panel-Mount Retrofit Assembly

Ventilation Spacing

To meet ventilation clearance requirements for the Orbit 60 system, there should be no hardware mounted within the 3 inches (75 mm) above or below the Orbit 60 chassis. Orbit 60 ventilation spacing requirements are described in more detail in the *System Module User Guide* (document 142M9080).

Power Supplies



This panel-mounted retrofit kit does not provide additional mounting hardware (such as a DIN-rail) for external power supplies, external barriers, or an external display PC. Users must secure their own method for accommodating these.

The 3500 Power Input Modules (PIMs) had a variety of models to accommodate a range of AC and DC power sources. However, the Orbit 60 PIMs only work with a low voltage DC supply. Therefore, the location and installation of AC/DC power supplies is an important retrofit consideration. These detailed considerations include satisfying the necessary 2 inch (50 mm) ventilation keep-out clearances above and below the power supplies. Also note that the power supplies must be installed on horizontal DIN rails to meet the power supply temperature specifications, and independent redundant power supplies are always recommended.



Ensure that power supplies and the high voltage power supply wiring maintains proper separation distance from signal wiring.

Power Supply Wiring Connections

Orbit 60 PIMs utilize spring-loaded connections. Therefore, ferruled wires are recommended for the wiring from the DC power supplies. Refer to *System Module User Guide (document 142M9080)* for supported wiring sizes and installation recommendations.



Wiring sizing requirements must comply with local electrical codes.

Also note that the ground wiring layout differs from the 3500's grounding method which used a switch on the Power Input Module to toggle a connection between common and earth ground. Orbit 60 has both a signal ground and earth ground connection which can be connected separately for Intrinsically safe or other applications. Otherwise, the I.S. and P.E. points should be connected together and grounded.

7. Orbit 60 Weatherproof Housing (3500/06) Retrofit Considerations

Weatherproof Housing (3500/06) Version Compatibility

While the 3500/06 is available with a wide range of configuration options, only the following configuration options of fully contained enclosures using a full-sized 3500 rack are compatible with the 3U Weatherproof Housing (WPH) Retrofit adapter kit:

- 3500/06-01-BB-CC-DD Powder-coated steel housing (full sized rack)
- 3500/06-02-BB-CC-DD Stainless steel housing (full sized rack)

Orbit 60 Weatherproof Housing Cautions and Limitations

WPH Retrofits not compatible with 6U Chassis

An Orbit 60 6U chassis is not compatible with the 3500/06 WPH with any retrofit kit or any other adapter. The 3500/06 does not meet ventilation clearance requirements and there is no means to secure the Orbit 60 system within the 3500/06 housing. A 3U Orbit 60 chassis is always recommended when replacing an existing 3500 rack within its 3500/06 WPH.

WPH Retrofit Kit not compatible with Door Only Version

Currently, the Orbit 60 3U WPH Retrofit Kit is not compatible for installations with the 3500/06 'door only' full-sized rack versions (3500/06-03-BB-CC-DD or 3500/06-04-BB-CC-DD) or 'door only' mini-rack versions (3500/06-05-BB-CC-DD or 3500/06-06-BB-CC-DD). The 3U WPH retrofit kit only supports the 'Fully Enclosed' WPH versions.

WPH Retrofit Kit not compatible with Mini-rack

Due to the physically wider chassis of the Orbit 60 chassis, the 3U WPH Retrofit Kit Orbit 60 systems are NOT compatible with any of the 3500/06 mini-rack versions (3500/06-07-BB-CC-DD, 3500/06-08-BB-CC-DD, 3500/06-05-BB-CC-DD or 3500/06-06-BB-CC-DD). Retrofitting 3500 system mini-rack installations will require individual evaluation.

WPH Retrofit Kit not directly compatible with 3500 Internal Barriers

Since the Orbit 60 system does not support internal barriers, replacing an internal-barrier 3500 system will require extra evaluation and custom installation/solution. Due to space constraints within the WPH, the external barriers required for the Orbit 60 would need to be installed in an additional, separate weather-proof housing.

Orbit 60 3U Chassis 3500/06 Weatherproof Housing Installation

Beyond the above exceptions, the 60X/RFT04 retrofit kit (nickel plated steel filler panel), an Orbit 60 3U rack-mount chassis and external power supplies can be retrofitted within an existing 3500/06 weatherproof housing (powder-coated or stainless steel) without physical modification of the installed 3500/06. This retrofit kit utilizes a width-adjustable two-piece filler panel and power supply

mounting hardware to aid during installation and provide DIN rail mounting locations for the external power supplies. The Orbit 60 front mounting brackets are not utilized with this kit as the two-piece filler panel has integrated front mounting supports. Any of the Orbit 60 3U chassis variants (rack mount, panel mount, or bulkhead) are compatible as the Orbit 60 front chassis mounting brackets or panel mount brackets are not used. A T10 Torx L-key and 5/32 hex L-key is provided with the kit to aid in the installation.

Table 6: 60X/RFT04 Weatherproof Housing Retrofit Kit Components

BN Part Number	Description	Quantity
187M5594-01	Filler Panel Sections (Nickel-Pated Steel)	2
04344178	10-32 Phillips screw (Stainless Steel)	14
04281412	#10 Flat Washer (Stainless Steel)	14
Rear Bracket Hardware		
184M4356-01	Power Supply Bracket (Aluminum)	2
187M8163	¼-20 countersink Screws	10
130924-0500	5" 35mm DIN rail	2
Provided Tools		
184M7874	T10 Torx L-Key	1
187M8168	5/32 Hex L-Key	1



Two extra 10-32 Phillips screws, #10 flat washers, and ¼-20 countersink screws are provided with the 60X/RFT04 kit.

60X/RFT04 Retrofit Kit Installation Overview

Complete installation instructions can be found in document 187M1495. Completely review the 187M1495 assembly details prior to starting any retrofit.

1. Remove the existing 3500 system and disconnect the associated field wiring.
2. Remove Orbit 60 front bezel and front chassis mounting bracket (via six 6-32 screws) and panel mount clamps (if ordered) but keep the screws for fastening to the adapter.
3. Secure the kit's aluminum power supply mounting brackets with eight ¼-20 hex flat head screws to each side of the Orbit 60 chassis.
4. Loosely assemble the two halves of the retrofit filler panel.
5. Insert the Orbit 60 chassis with the attached power supply mounting brackets through the rear opening of the 3500/06 housing. Push the Orbit 60 as far forward as possible through the front opening of the housing.
6. Attach the filler panel to the Orbit 60 chassis reusing the (qty 6) 6-32 screws.

7. Secure the filler panel to the front of the housing with the (qty 4) 10-32 screws.
8. Tighten the remaining (qty 4) 10-32 screws which secure the two filler panel sections.
9. Attach the two DIN rails using the (qty 4) 10-32 screws to the power supply mounting brackets.
10. When using local AC power sources, install the two DC Power Supplies on either DIN rail. Then terminate to external power wiring. Complete by terminating the sensor field wiring to the Orbit 60 system.

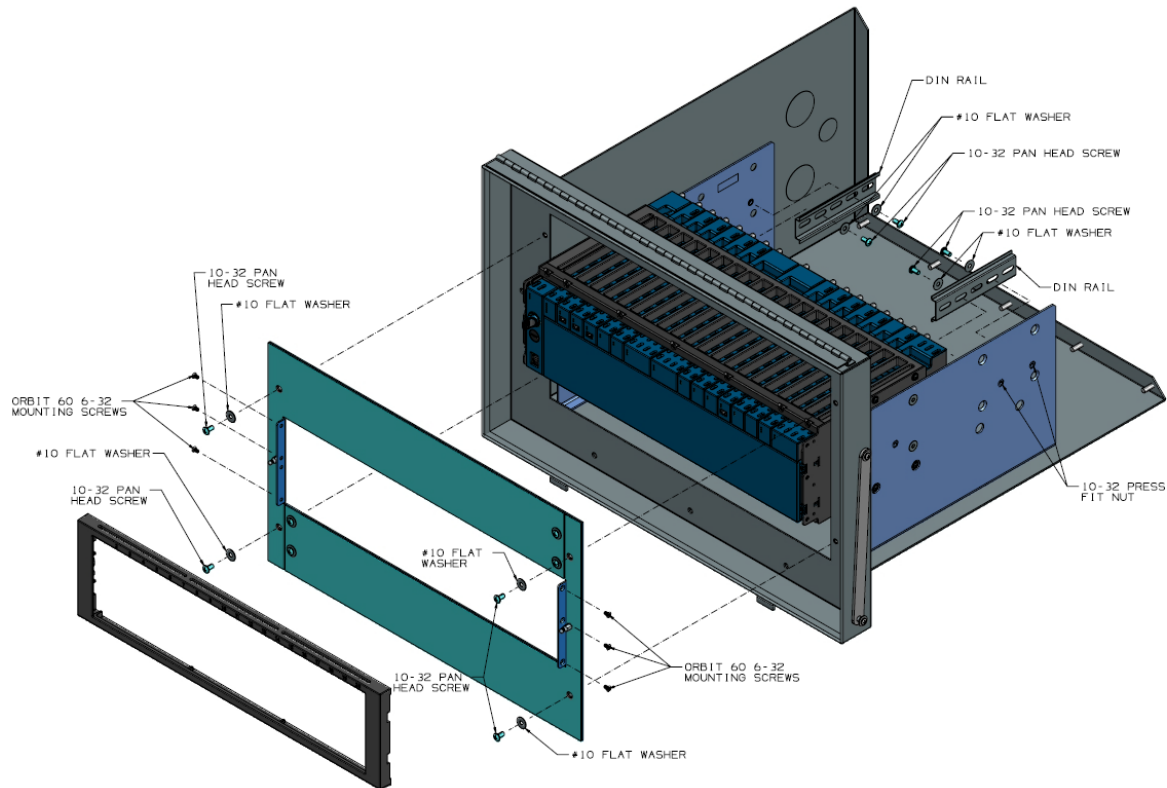


Figure 8: 60X/RFT04 Retrofit Kit Assembly (3500/06 housing top and side not shown for visibility, See Installation Document 187M1495)

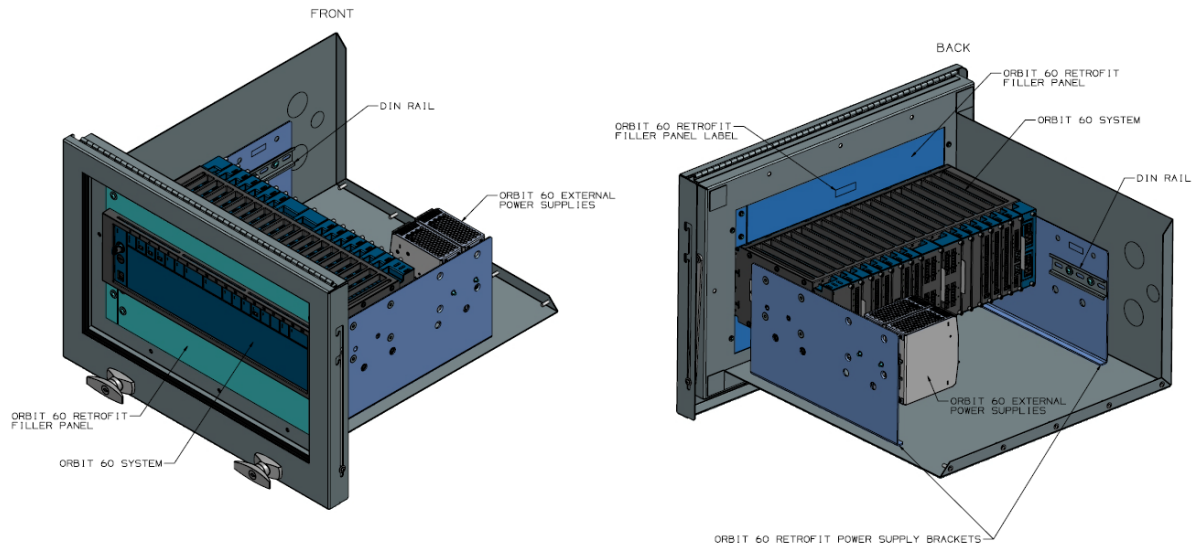


Figure 9: Assembled 60X/RFT04 Retrofit kit (3500/06 housing top and side not shown for visibility, See Installation Document 187M1495)

Ventilation Spacing and Cooling Requirements

To meet ventilation clearance requirements for the Orbit 60 system, there should be no hardware mounted within the 3 inches (75 mm) above or below the Orbit 60 chassis. Orbit 60 ventilation spacing requirements are described in more detail in the System Module User Guide (document 142M9080). This retrofit kit maintains this 3-inch ventilation spacing requirement within the 3500/06 housing.



Within the 3500/06 housing, do not place any equipment or objects below or above the Orbit 60 3U chassis that would restrict cooling airflow.

When using the 3500/06 weatherproof housing, precautions should be taken to avoid operating the Orbit 60 system above the systems temperature specifications. Due to the heat dissipation by the Orbit 60 system, do not install the 3500/06 housing in direct sunlight.



Exceeding the specified operating temperature of the Orbit 60 system may degrade the reliability of the monitoring system and potentially ignite some gases.

Before installing an Orbit 60 system within a 3500/06 housing, consult with Figure 10 to ensure proper ambient temperature requirements are met.



If Orbit 60 system external power supplies are installed within the 3500/06 housing, multiply the power consumption of the Orbit 60 system by 1.07 to account for the heat generated by the power supplies..

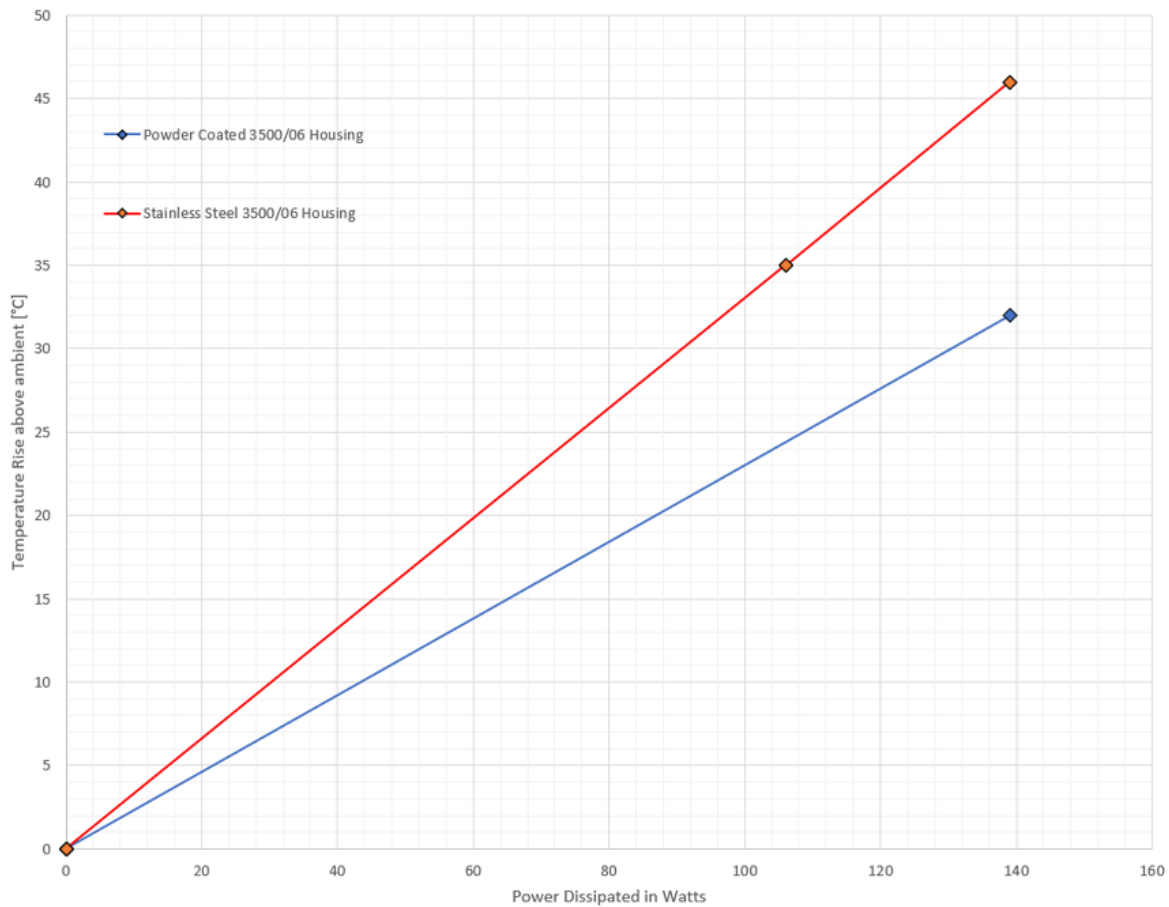


Figure 10: Orbit 60 Temperature Derating Graph

Table 7 and Table 8 are air purge specifications for the 3500/06 weatherproof housing.

Table 7: N.F.P.A. 496 5X Air Purge Specifications (Source Document 141528)

Pressure		Flow through air purge pipe		Time for purging weatherproof housing
in. of water	kPa	cu. ft./min.	m ³ /hour	minutes
1.0	0.25	1.08	1.83	14
1.5	0.37	1.25	2.12	12
2.0	0.50	1.42	2.42	11
2.5	0.62	1.57	2.67	10
3.0	0.75	1.72	2.92	9
3.5	0.87	1.85	3.14	8
4.0	1.00	2.00	3.40	8

Pressure		Flow through air purge pipe		Time for purging weatherproof housing
in. of water	kPa	cu. ft./min.	m ³ /hour	minutes
4.5	1.12	2.11	3.58	8
5.0	1.25	2.22	3.77	7
5.5	1.37	2.33	3.96	7
6.0	1.50	2.42	4.11	7
6.5	1.62	2.50	4.25	6
7.0	1.74	2.59	4.40	6
7.5	1.87	2.67	4.54	6
8.0	1.99	2.74	4.66	6
8.5	2.12	2.80	4.76	6
9.0	2.24	2.87	4.88	6
9.5	2.37	2.93	4.98	6
10.0	2.49	3.00	5.10	5

Table 8: 10X Purge per Canadian Electrical Code C22.1, Part 1 Air Purge Specifications

Pressure		Flow through air purge pipe		Time for purging weatherproof housing
in. of water	kPa	cu. ft./min.	m ³ /hour	minutes
1.0	0.25	1.08	1.83	14
1.5	0.37	1.25	2.12	12
2.0	0.50	1.42	2.42	11
2.5	0.62	1.57	2.67	10
3.0	0.75	1.72	2.92	9
3.5	0.87	1.85	3.14	8
4.0	1.00	2.00	3.40	8
4.5	1.12	2.11	3.58	8
5.0	1.25	2.22	3.77	7
5.5	1.37	2.33	3.96	7

Pressure		Flow through air purge pipe		Time for purging weatherproof housing
in. of water	kPa	cu. ft./min.	m ³ /hour	minutes
6.0	1.50	2.42	4.11	7
6.5	1.62	2.50	4.25	6
7.0	1.74	2.59	4.40	6
7.5	1.87	2.67	4.54	6
8.0	1.99	2.74	4.66	6
8.5	2.12	2.80	4.76	6
9.0	2.24	2.87	4.88	6
9.5	2.37	2.93	4.98	6
10.0	2.49	3.00	5.10	5

Power Supplies

The 60X/RFT04 retrofit kit provides two DIN-rail mounting locations for Orbit 60 system external power supplies within the 3500/06 housing. Two Orbit 60 external power supplies can be installed together on either DIN-rail or one power supply on each DIN-rail.

The 3500 Power Input Modules (PIMs) had a variety of models to accommodate a range of AC and DC power sources. However, the Orbit 60 PIMs only work with a low voltage DC supply. Therefore, the location and installation of AC/DC power supplies is an important retrofit consideration. These detailed considerations include satisfying the necessary 2 inch (50 mm) ventilation keep-out clearances above and below the power supplies. Note that the power supplies must be installed on horizontal DIN-rails to meet the power supply temperature specifications, and independent redundant power supplies are always recommended.



Ensure that power supplies and the high voltage power supply wiring maintains proper separation distance from signal wiring.

Power Supply Wiring Connections

Orbit 60 PIMs utilize spring-loaded connections. Therefore, ferruled wires are recommended for the wiring from the DC power supplies. Refer to System Module User Guide (document 142M9080) for supported wiring sizes and installation recommendations.



Wiring sizing requirements must comply with local electrical codes.

Also note that the ground wiring layout differs from the 3500's grounding method which used a switch on the Power Input Module to toggle a connection between common and earth ground. Orbit 60 has both a signal ground and earth ground connection which can be connected separately for

Intrinsically safe or other applications. Otherwise, the I.S. and P.E. points should be connected and grounded.

8. Orbit 60 Bulkhead-Mount Retrofit Considerations

A bulkhead-mount retrofit kit (part number 60X/RFT06) is offered to easily facilitate the replacement of a 3500 bulkhead-mount chassis with an Orbit 60 chassis. The kit provides an adapter plate that enables Orbit 60 chassis mounting using existing 3500 mounting hardware (mounting studs/bolts). The bulkhead-mount retrofit kit is compatible with both 3U and 6U Orbit 60 chassis.

Bulkhead Mount Installation

The bulkhead mount retrofit kit contains an adapter plate, two optional DIN rails for accessory mounting, and M6 mounting hardware.

Table 9: 60X/RFT06 Retrofit Kit: Bulkhead Mount Components

BN Part Number	Description	Quantity
185M0271-01	Retrofit Adapter Plate	1
183M2774	M6 Nut	1
186M2908	M6 Washer	18
186M0470-01	425 mm long DIN rail	1
186M0471-01	475 mm long DIN rail	1
149M4972-01	Orbit 60 bulkhead mounting bracket	4
DIN Rail Accessories		
186M2918	Momentary push button	1
186M2906	2 position key switch	1
186M5134	Contact block with screw terminals	2
186M2905	DIN rail component mounting adapter	2

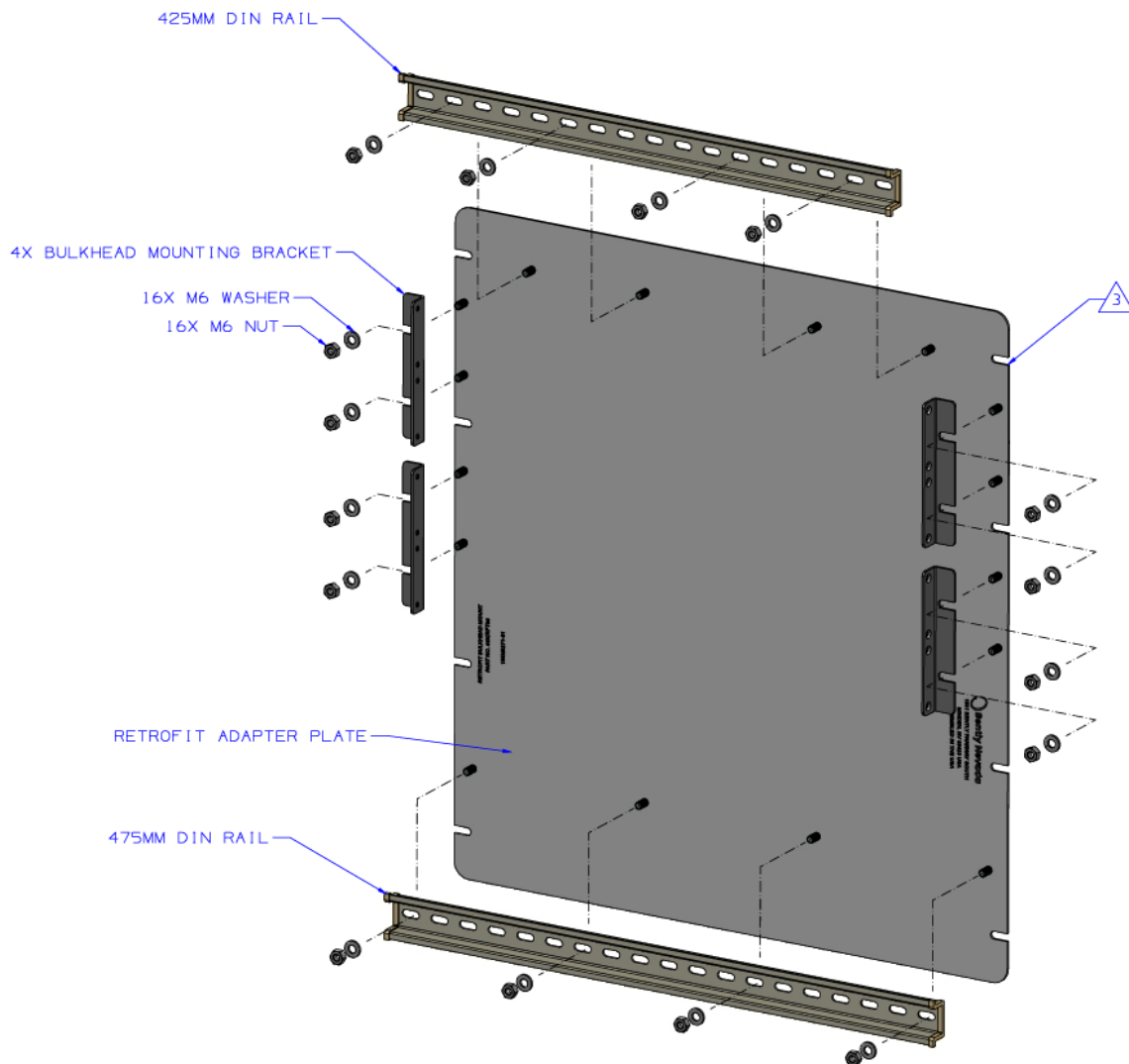


Figure 11: Bulkhead-Mount Retrofit Kit

After removing the 3500, the adapter plate can be mounted using the same mounting hardware that was used for 3500.



It may be necessary to replace excessively aged hardware. Inspect hardware for rust/corrosion or damage which could compromise the effectiveness of the fasteners.

Once the adapter plate is mounted, the Orbit 60 chassis may be mounted to the adapter plate using the bulkhead mount brackets and M6 hardware.

3U Chassis Mounting & DIN Rail Usage

The 3U Orbit 60 chassis may be mounted to the adapter plate in 1 of 2 locations. The chassis can be mounted using the 4 M6 studs closest to adapter plate etching (which contains the Bently Nevada logo and Part Number information), or it can be mounted using the 4 studs that are further from the etching. The image below shows the 3U mounted closer to the etching. In this configuration, there is enough clearance for both the 475 mm and 425 mm DIN Rail to be used for accessory mounting. This

configuration may be helpful, for example, when mounting external barriers on the 425 mm DIN Rail and still allowing power supplies and/or external display PC to be installed on the 475 mm DIN Rail. If the 3U is mounted further away from the etching, the 425 mm DIN Rail can't be used. Generally, the preferred location of the 3U chassis will be the one that aligns best with the existing field wiring.

The adapter plate and Orbit 60 chassis may be installed in any orientation provided that the 3U system is mounted upright. The orientation shown below is for reference only. Only one 3U system can be mounted on the adapter plate.

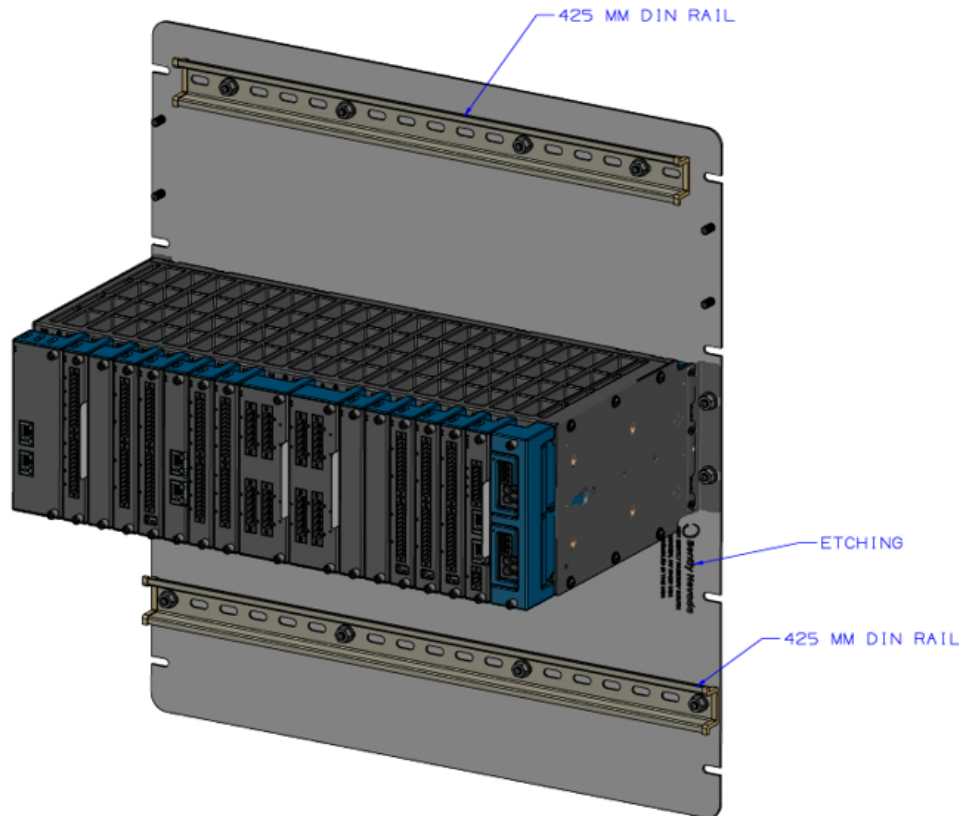


Figure 12: Example of Mounting on the Adapter Plate

6U Chassis Mounting & DIN Rail Usage

The 6U Orbit 60 chassis must be mounted to the adapter plate using the 8 M6 studs, as shown below. The 425 mm DIN Rail can't be used with a 6U chassis.

Like the 3U, the adapter plate and the 6U chassis can be mounted in any orientation provided that the 6U system is mounted upright. The orientation shown below is for reference only.

The mounting brackets supplied with the 6U system must be removed and replaced with the 4 brackets supplied with the bulkhead retrofit kit. This provides clearance for the adapter plate mounting hardware.

The power supplies can be mounted on the 6U system as shown if the enclosure depth can accommodate the additional depth of the power supplies mounted on the 6U system. Alternatively, the power supplies can be installed on the 475 mm DIN Rail to match the depth of the existing 3500 bulkhead rack.

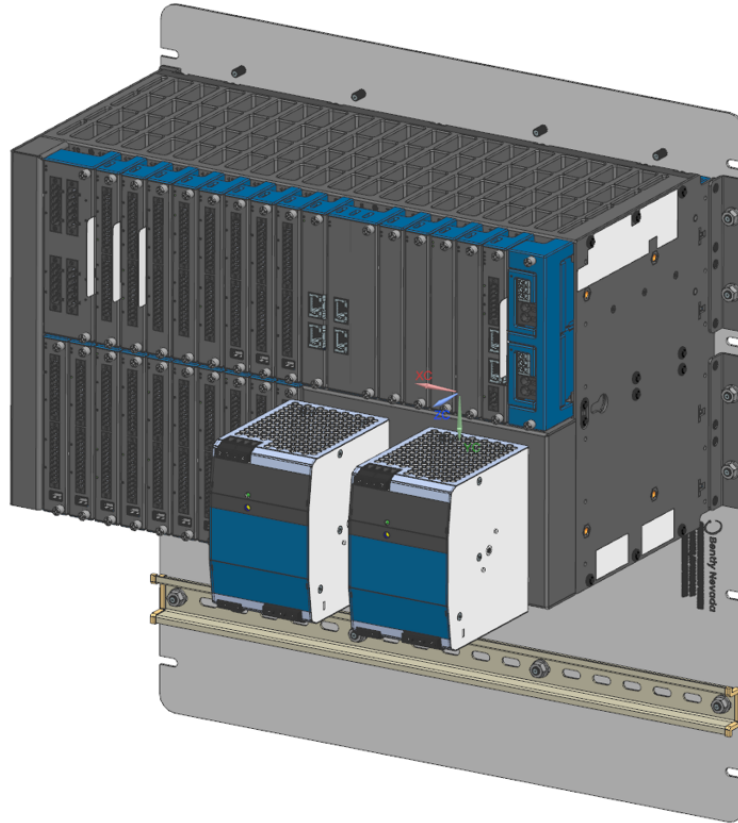


Figure 13: Chassis Mount Example

Ventilation Spacing

The required ventilation spacing of 3 inches (75 mm) above and below the Orbit 60 chassis must be maintained when mounting accessories to the DIN Rail. For this reason, the power supply can **not** be mounted to the 425 mm DIN Rail. Take care when using the DIN Rail to maintain ventilation spacing. (Orbit 60 ventilation spacing requirements are described in more detail in the *System Module User Guide* [document 142M9080].)

DIN Rail Accessories

A two-position key switch and a momentary push button are provided with the bulkhead-mount retrofit kit. These off-the-shelf accessories are meant to provide an alternative solution to the Rack Reset push button and Run/Program key switch switch functionality found on a 3500 bulkhead system, but they can also be used for any other suitable application. The kit also includes off-the-shelf plastic DIN Rail mounting adapters and contact blocks that are compatible with the key switch and push button. There are no ventilation spacing limitations on the DIN rail mounting location for these accessories.

9. Protection Systems

For systems that provide shutdown functionality, either through direct wiring of relays, recorders, or through the communication of measurements the control system uses to trip, consider the following system aspects:

While the Orbit 60 system has high availability and high reliability when implemented in either a basic simplex or in more complex redundant deployments, Bently Nevada recommends that all applications of the Orbit 60 system for protection follow the guidelines below:

1. Use relays as the Orbit 60 protection output.
2. Monitor the SIM's protection Fault Relay to validate that the system is protecting the machine.
3. Use redundant protection processor modules to allow fault tolerance and system repair if a module fails.
4. Use redundant Power Input Modules (PIM) on each chassis with each PIM wired to separate power supplies using functionally independent external 24 V power sources.
5. Wire sensors on the same location on the shaft to separate input modules (e.g., X probes and Y probes from the same bearing wired to separate input modules).

10. API 670 Deployments

This section describes monitoring and protection of a typical API 670 compressor for definition and discussion purposes.

API – Motor–Gearbox–Compressor

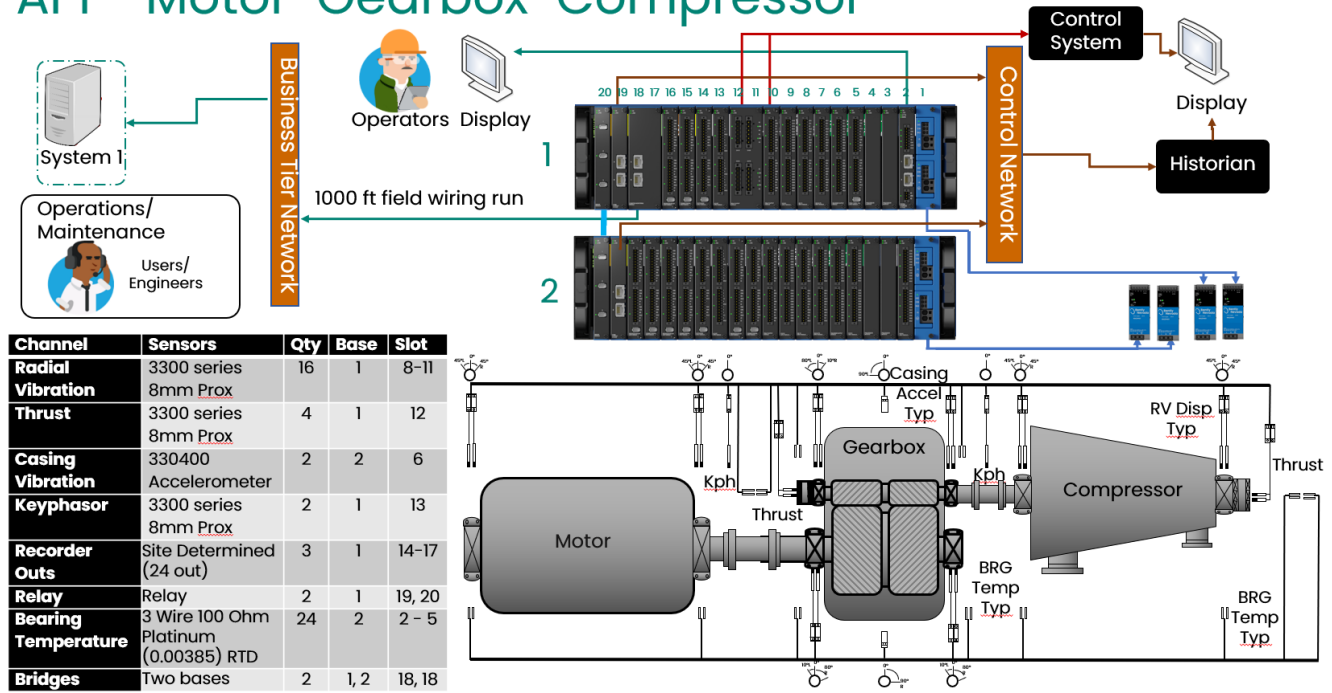


Figure 14: Monitoring and Protection Scheme for Typical API 670 Compressor

For retrofit installations of API 670 applications, the following installation details are recommended:

1. Two redundant Power Input Modules (PIM).
2. Two redundant, independent 24 V Power Supplies.
3. Redundant Protection Processing Modules (PPM).
4. Electro-Mechanical relay (EMR) (Solid State Relay is also valid, if requested).
5. Connection of protection fault relay.
6. Single machine train and protection group per system.
7. X and Y vibration sensors from a common bearing wired to separate input modules.

11. Hazardous Areas

Orbit 60 meets or exceeds the hazardous area classifications of the 3500, but regulatory changes necessitate specific differences in implementation. You must evaluate each hazardous area installation prior to retrofit. The installation allowances and calculations for the 3500 system may not be sufficient to allow the installation of an Orbit 60 in the same manner.

1. **Installations using 3500 internal barrier I/O modules**– If the existing installation uses the 3500 I/O modules with internal barriers, the retrofit scope must include services scope for an entity parameter evaluation of the installed sensors as well as the purchase and installation of external barriers. In release 1 of the product, there are no internal barriers. Physical room for external barrier modules must be provided.
2. **Installations using external barriers or isolators**– If the retrofit currently uses non-BN barriers or isolators, it is recommended to refer to the Orbit 60 input module datasheets to determine the recommended barriers and isolators. Generally, the existing components used for 3500 can be re-used for Orbit 60; however, there are exceptions such as the currently recommended Orbit 60 barrier for RTDs, which requires a different 2-channel barrier.

Refer to the Orbit 60 Field Wiring Diagram package to review the recommended barrier or isolator wiring details.

3. **Installations that follow the nL (non-incendive) implementation**– These are Hazardous area installations with sensors wired directly to non-internal barrier I/O modules. This method of achieving hazardous area safety is no longer supported outside of North America. An existing nL solution cannot be grandfathered in using an Orbit 60 device. A retrofit of this type of installation must include services scope for a technical evaluation of the installation. There are three primary methods to retrofit these installations:
 - **Use external barriers (ic or ia protection scheme)**
The specifics of the installation must be evaluated to ensure the chosen barrier meets or exceeds the entity parameters the 3500 installation provided. Appropriate Earthing Ground requires review or modification of the system ground connection capabilities.
 - **Use isolators**
An external power supply with the capacity to power the isolator is required. Space within the installation for installing the isolators and power supplies is required.
 - **Use nA or Ec protection scheme**
Field wiring changes are required to meet the specifics of this scheme, including field wiring in conduits, IP54 junction boxes, and so on.

12. Field Wiring

Retrofit applications will generally not alter field wiring. Retrofits must interface to the existing transducer wiring rather than using advanced features such as remote I/O bridging solutions.

To avoid future issues with insulation, aging, and terminations leading to sensor signal integrity issues, it is Bently Nevada's recommendation that all field wiring greater than 20 years old be replaced as a part of the retrofit. While the field wiring may be acceptable at the time of the retrofit, the operational life of the Orbit 60 installation will be in excess of 15 years, leading to a total field wiring lifespan of greater than 35 years.

Field Wiring Retrofit Considerations

3500 Internal Terminations

If existing signal wiring was terminated directly at the back of the 3500 I/O modules (i.e. internal terminations) the green 3500 terminal connectors must be removed and replaced with the wiring connectors supplied with the Orbit 60 system.



Ensure that the existing wiring is labeled and documented thoroughly before de-terminating the wiring from the 3500 system.



The 3500 chassis was deeper than the Orbit 60 chassis. Therefore, it is important to know how this will affect the field wiring, based on the direction of the incoming wiring and any available wiring service loops. The location of the Orbit 60 chassis used in the retrofit may be slightly adjusted in the cabinet to optimally match the existing cable runs, while still maintaining the required ventilation clearances and proper power cable routings.

3500 External Terminations

If the existing signal wiring is terminated at 3500 External Termination Blocks (ETBs), it is important to understand that the external termination cables are not directly compatible with the Orbit 60. With the exception of thermocouples, Orbit 60 does not provide specific I/O modules for external terminations. Instead, a series of adapters is available to connect ETB cabling to existing Orbit 60 modules to minimize re-design and installation impact when retrofitting these installations.



Special care must be taken when thermocouples are a part of the installation. Special Orbit 60 thermocouple ETB input modules are available to interface to these installations through an adapter. See Thermocouple section below.



Where an adapter is not available, the user may purchase generic D-Sub to “flying lead” cables. The correct D-Sub sizes must be selected to match the size(s) of connectors of the 3500 ETB block. Then the individual conductors must be terminated at the Orbit 60. The wiring layout must ensure that the individual conductors are terminated at the appropriate Orbit 60 input pins. To ensure the complete wiring connections are made, refer to the applicable 3500 User Manuals to understand the D-sub output pins used and then cross-reference that information with the Orbit 60 Field Wiring Diagrams to determine where the appropriate conductors must be terminated.

External Termination Adapters are selected based on the 3500 I/O module being utilized and then configured based the sensor type connected to each channel. The below table is an overview of adapter vs 3500 I/O type, for details refer to follow on sections for each 3500 I/O type or refer to the Orbit 60 field wiring diagram.

3500 Montior	I/O type	ETB Part Number	Retrofit Part Numbers
3500/25	Speed/Keyphasor	128726-01 or 128718-01	Ext Termination Adapter - KPH (60X/ETA09)
3500/25	Isolated KPH/Magnetic Pickup	128726-01 or 128718-01	Ext Termination Adapter - KPH (60X/ETA09)
3500/40	Radial Vibration/Thrust	128015-01 or 125808-01	Ext Termination Adapter - PAV/PVT/PAA (60X/ETA03)
3500/42	Prox/Velom	128015-08 or 125808-08	Ext Termination Adapter - PAV/PVT/PAA (60X/ETA03)
3500/42	Prox/Seismic	128015-02 or 125808-02	Ext Termination Adapter - PAS (60X/ETA04)
3500/42	Shaft Absolute	140993-01 or 141001-01	Ext Termination Adapter - Universal (60X/ETA01) External Termination Block - Universal (60X/ETB01)
3500/44	Prox/Velom	128015-08 or 125808-08	Ext Termination Adapter - PAV/PVT/PAA (60X/ETA03)
3500/45	Position	128015-06 or 125808-06	Ext Termination Adapter - Universal (60X/ETA01) External Termination Block - Universal (60X/ETB01)
3500/45	ACLVDT	141216-01 or 141208-01	Ext Termination Adapter - ACLVDT (60X/ETA02)

3500 Montior	I/O type	ETB Part Number	Retrofit Part Numbers
3500/46	Prox/Velom	128015-08 or 125808-08	Ext Termination Adapter - PAV/PVT/PAA (60X/ETA03)
3500/46	Cylinder Pressure	128015-10 or 125808-10	Ext Termination Adapter - PAV/PVT/PAA (60X/ETA03)
3500/62	-10 to +10 pv	136595-01 or 136603-01	Ext Termination Adapter - PV/DI Voltage (60X/ETA06)
3500/62	4-20ma PV - iso	136595-01 or 136603-01	Ext Termination Adapter - PV/DI Current (60X/ETA07)
3500/64	Dynamic Pressure	128015-09 or 125808-09	Ext Termination Adapter - PAV/PVT/PAA (60X/ETA03)
3500/70	Prox/Velom	128015-08 or 125808-08	Ext Termination Adapter - PAV/PVT/PAA (60X/ETA03)
3500/72	Prox/Velom	128015-08 or 125808-08	Ext Termination Adapter - PAV/PVT/PAA (60X/ETA03)
3500/77	Cylinder Pressure	128015-10 or 125808-10	Ext Termination Adapter - PAV/PVT/PAA (60X/ETA03)
3500/60	TC/RTD (6 channel RTD Only)	133908-01 or 133916-01	Ext Termination Adapter - RTD (60X/ETA05)
3500/61	TC/RTD with REC (6 Channel RTD Only)	133908-01 or 133916-01	Ext Termination Adapter - RTD (60X/ETA05)
Recorder connections on 3500/40/42/44/45/46/64/70/72/77	Recorder connections on 4 channel I/O cards	128702-01 or 128710-01	Ext Termination Adapter - Recorder (60X/ETA08)

For the following applications, there is not a simple 1:1 adapter solution, and special consideration must be taken into account to retrofit successfully.

Monitor Card	I/O and Connection	3500 ETB	Discussion Note
All non-4 channel cards	Recorder Out connections on 6+ channel input cards	133900-01 or 133892-01	A

Monitor Card	I/O and Connection	3500 ETB	Discussion Note
3500/44	Aero GT	128015-03 or 125808-03	B
3500/44 or /46	Multimode Prox/Velom	128015-11 or 125808-11	B
3500/44 or /46	Recorder output connections for multimode	128015-13 or 125808-13	B
3500/46	Multimode positive input	128015-12 or 125808-12	B
3500/50	Zero Speed and Peak Speed	128015-05 or 125808-05	B
3500/65	TC/RTD	172115-01	A, C
3500/60	ISO TC Temp	133924-01 or 133932-01	C
3500/61	ISO TC Temp W/REC	133924-01 or 133932-01	C
Isolated TC recorder	ISO TC Temp W/REC	133924-01 or 133932-01	C

Special Wiring Discussion Notes:

- A. Due to mismatch in transducer connection allowed per module between 3500 and Orbit 60, the connections must be separated into blocks that can be connected to a single Orbit 60 input module. 3500 ETB must be replaced by an appropriate number of Orbit 60 universal 24 connector ETB blocks and associated 25 pin cables. For example, a 3500/65 16 channel temperature module would require the use of 3 universal Orbit 60 ETB blocks, each capable of managing 6 transducers to retrofit.
- B. 3500 installations implemented system controls for certain applications individually at the monitor level and were connected to the individual monitor I/O cards. Orbit 60 provides these system controls through a separate discrete input card. For installations that utilize system controls at the 3500 I/O, these field wiring terminations need to be removed from the 3500 ETB and landed on a separate universal Orbit 60 ETB to connect to a PV/DI card. In most cases, controls that were connected to multiple 3500 I/Os can be aggregated to one input on the DI card. For example, an Aeroderivative application that has three 3500/44M cards utilizing special alarm inhibit will only require one special alarm inhibit contact into the DI card on orbit 60.
- C. Any external termination installation that includes thermocouples cannot utilize the existing 3500 TC external termination block. Thermocouples require cold junction temperature compensation (CJC) wherever the field wiring is landed, for external terminations this compensation is done by components on the external termination block. 3500 and Orbit 60

utilize differing CJC components that are not interchangeable, the 3500 external termination block must be replaced as a part of the retrofit.

Various 3500 Channel and I/O Module Types

The below diagrams specific to retrofitting 3500 ETB installations are provided for reference. Always refer to *Orbit 60 Field Wiring Diagram Package (document 150M3659)* for the latest drawing revisions.

System Controls

General

3500 ETB I/O modules implemented system controls for certain applications at the monitor level through signals provided to the individual I/O cards. Orbit 60 provides these system controls through a separate discrete input card. For installations that utilize system controls at the 3500 I/O, these field wiring terminations need to be removed from the 3500 ETB and landed on a separate universal Orbit 60 ETB (60X/ETB01) to connect to a PV/DI card.



In most cases, controls that were connected to multiple 3500 I/Os can be aggregated to one Discrete Input on the PVD card. For example, a single machine Aeroderivative application that has three 3500/44M cards utilizing special alarm inhibit will only require one special alarm inhibit contact into the PVD card on Orbit 60.

Special Alarm Inhibit

Many 3500 I/Os are used for applications requiring special alarm inhibit. These applications utilize a contact for Special Alarm Inhibit functionality that is included as a part of the transducer ETB connection. Within Orbit 60, special alarm inhibit is handled through State Management. When retrofitting, the control wiring connection is removed from the transducer I/O and connected to a discrete input card per the below drawing.

Multimode Contacts

3500 multimode ETB I/O modules implemented system controls for Mode Control individually at the monitor level and were connected through the Recorder/Contact D-sub cable to the individual monitor I/O cards. these field wiring terminations need to be removed from the 3500 ETB and landed on a separate universal Orbit 60 ETB (60X/ETB01) to connect to a PVD card.

In most cases, system control contacts that were connected to multiple 3500 I/Os can be aggregated to one Discrete Input channel on the PVD card. For example, a single machine Aeroderivative application that has three 3500/44M cards utilizing one protection mode input will only require one contact into the PVD card on Orbit 60.

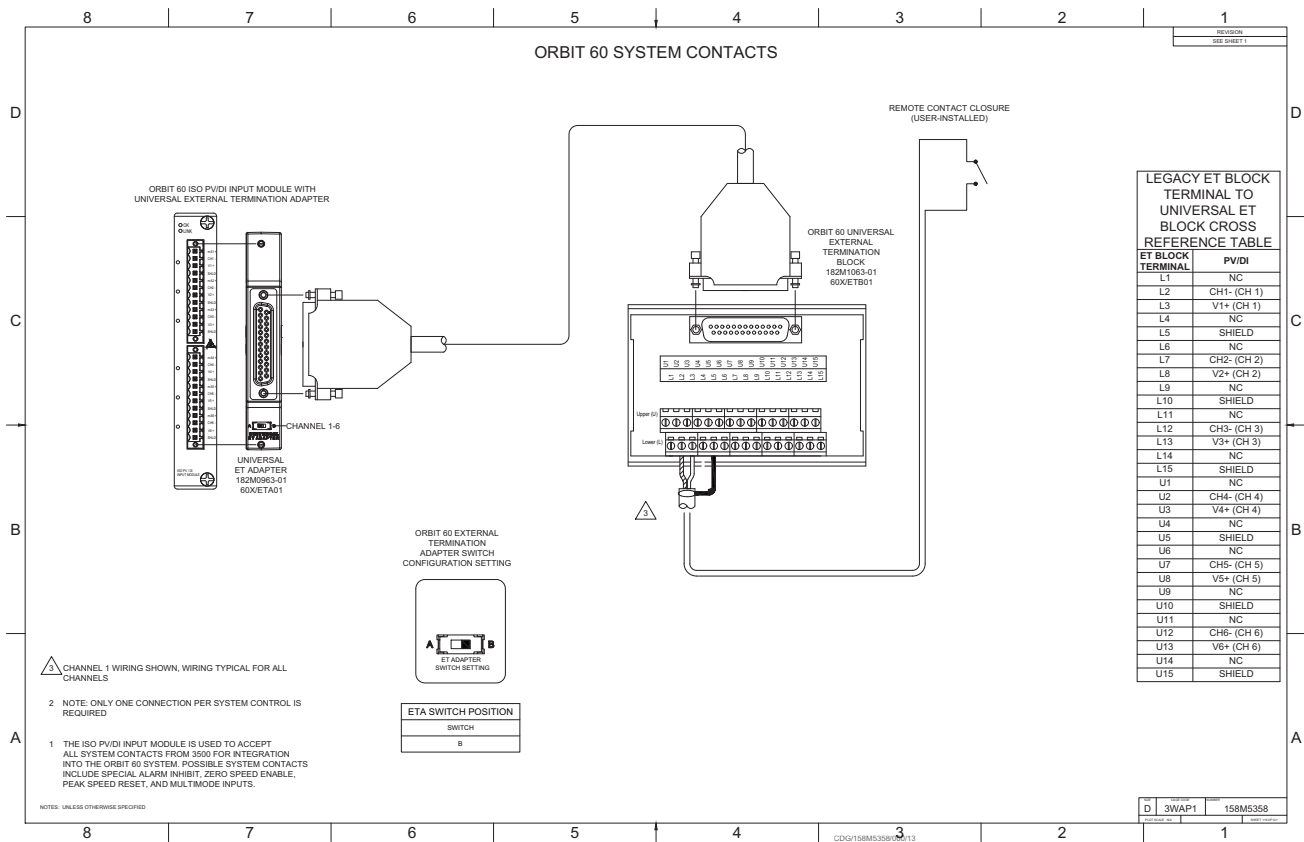


Figure 15: Contact Drawing

Recorder Outputs

The majority of 3500 4 channel applications that include recorder outputs utilize a 9 pin cable connected to the 3500 input module specifically for the recorder output connection. Orbit 60 utilizes a separate 8 channel card for recorder outputs. The existing 3500 ETB and cable can be re-used and the recorder outputs from two 4 channel 3500 modules can be aggregated into each Orbit 60 module using the 60X/ETA08 adapter to connect two 9 pin cables to one Orbit 60 recorder output card. The example below is common for all 4 channel (non-multimode) 3500 applications.

Exceptions include:

1. Multi-Mode I/O modules
2. 6 Channel Temperature I/O modules
3. 16 Channel Temperature I/O modules

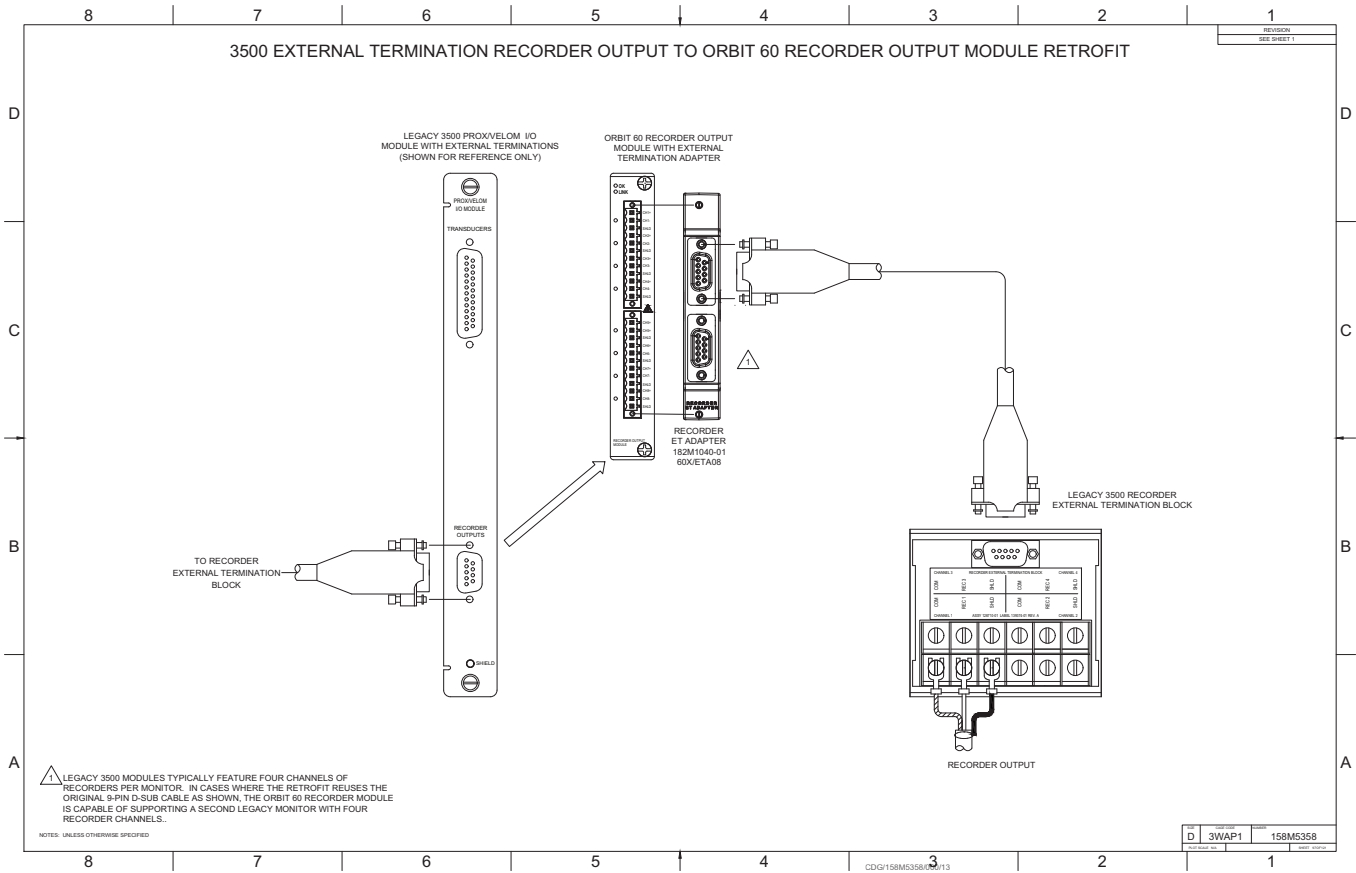


Figure 16: Recorder Outputs Drawing

Proximitor Input Module

When retrofitting a Proximitor I/O, the preferred Orbit 60 input card is the PAV. The specified adapter can be utilized for multiple sensor types, depending on connected sensor, the dip switch settings must be set appropriately.

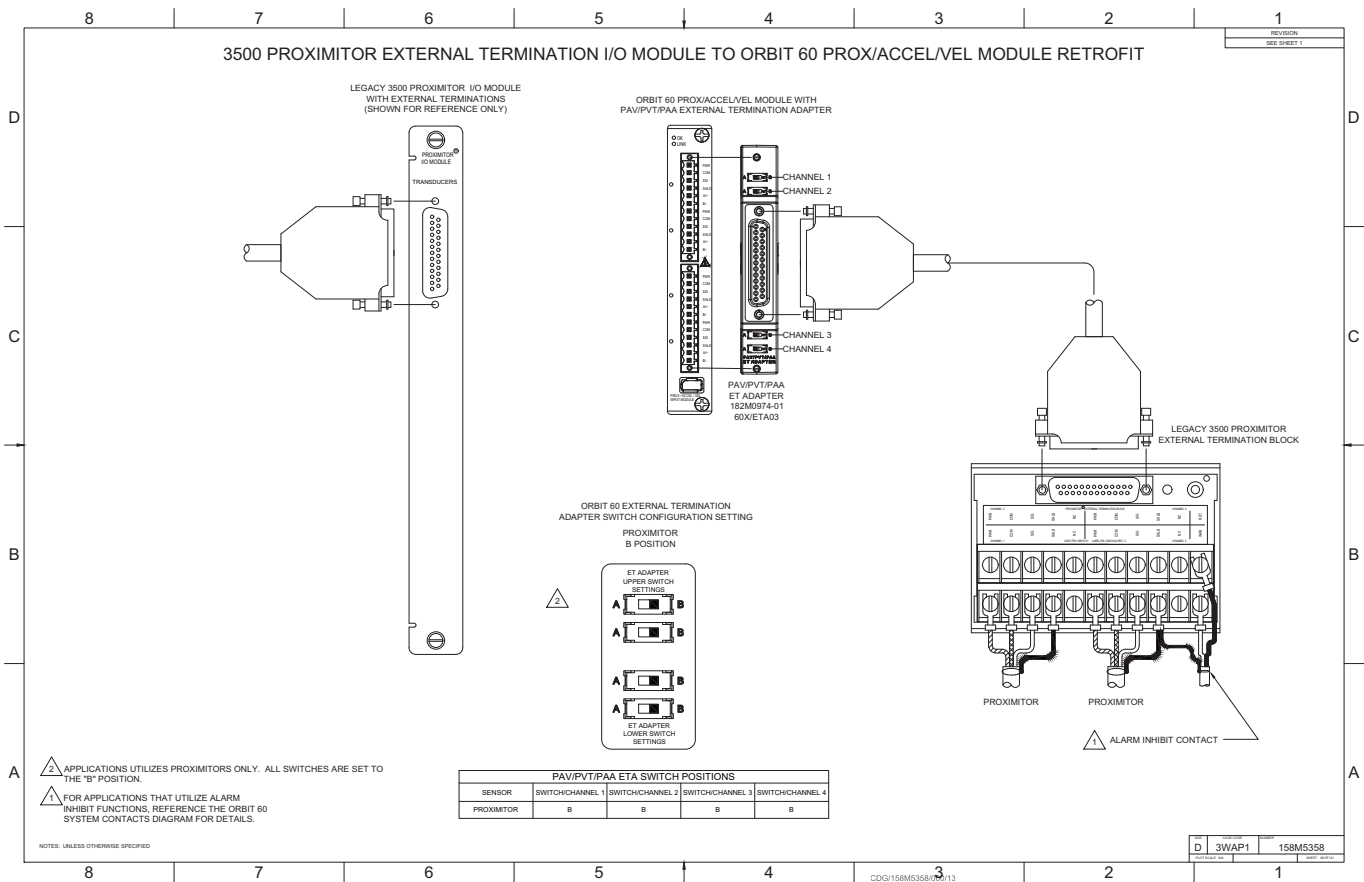


Figure 17: Proximator Input Drawing

Proximator I/Os can be used for applications requiring special alarm inhibit. Refer to special alarm inhibit section for details in connecting system alarm controls.

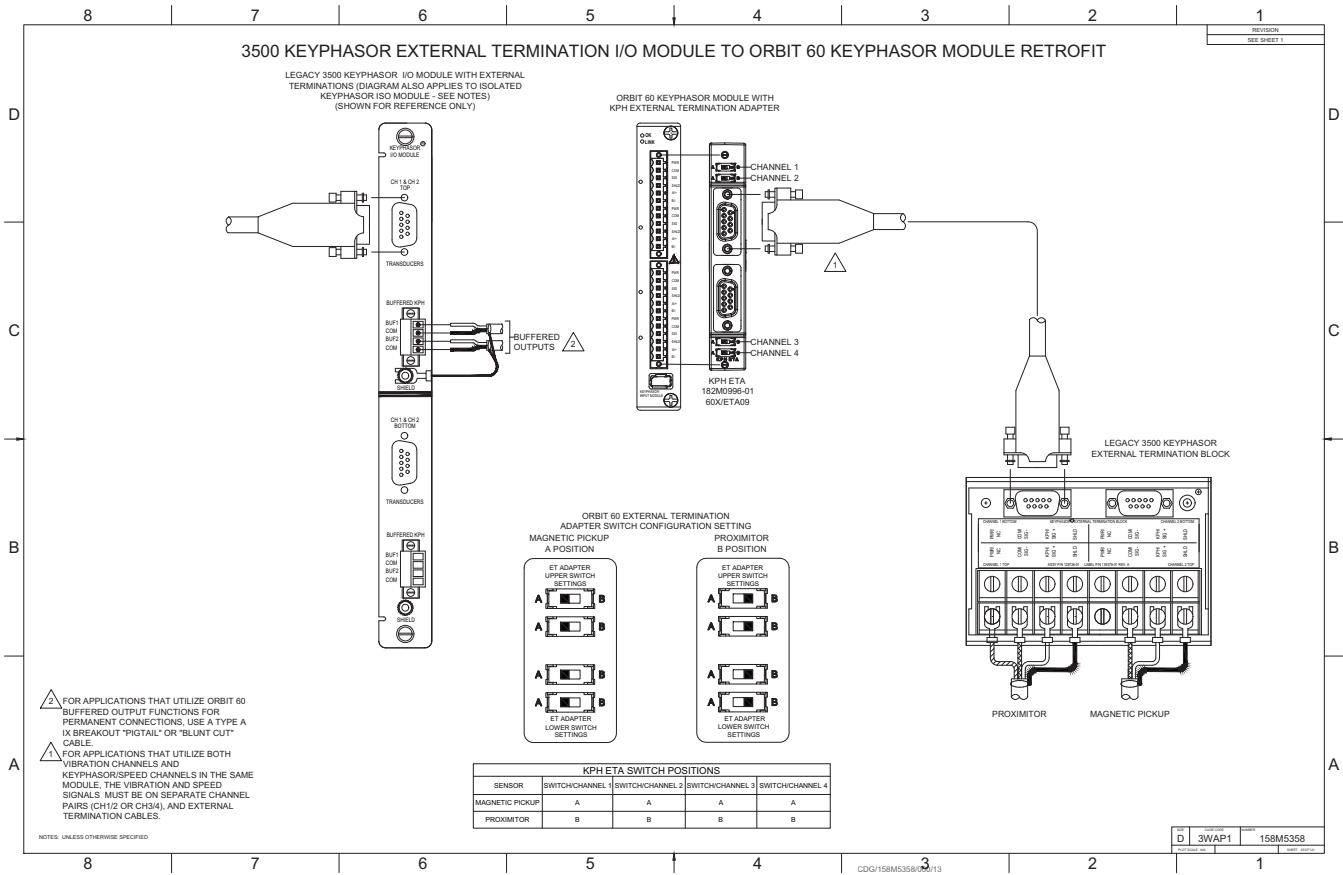
Reference [Figure 15: Contact Drawing on page 39](#).

Keyphasor and Isolated Keyphasor I/O Modules

For Keyphasor I/O module ETB installations, 3500 utilized two modules, an upper and a lower, each with 2 sensors connected via a 9 pin D-Sub cable. Both of these cards can be connected into a single Orbit 60 Keyphasor card utilizing an adapter that allows either one or two 9 pin D-sub to be connected as needed. The dip switch location is dependent on whether the sensor is a proximator or a magnetic pickup.



For installations that require the combination of speed channels and vibration channels in the same Keyphasor card, vibration channels cannot be included on the same ETB cable as the speed signals due to signal cross-talk effects.



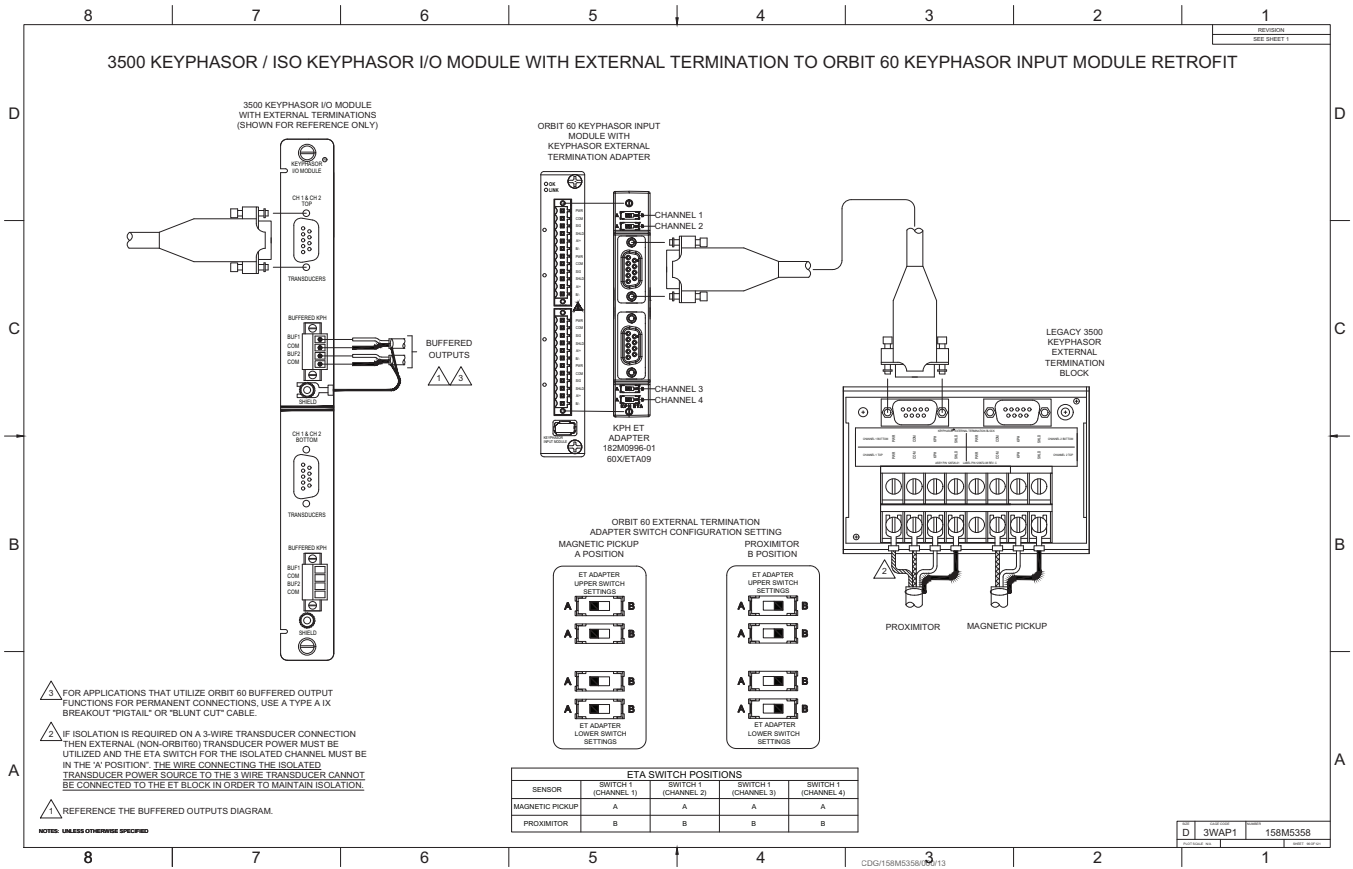


Figure 18: 3500 Keyphasor Drawings

3500 Tachometer installations will be connected to the Orbit 60 Keyphasor module.

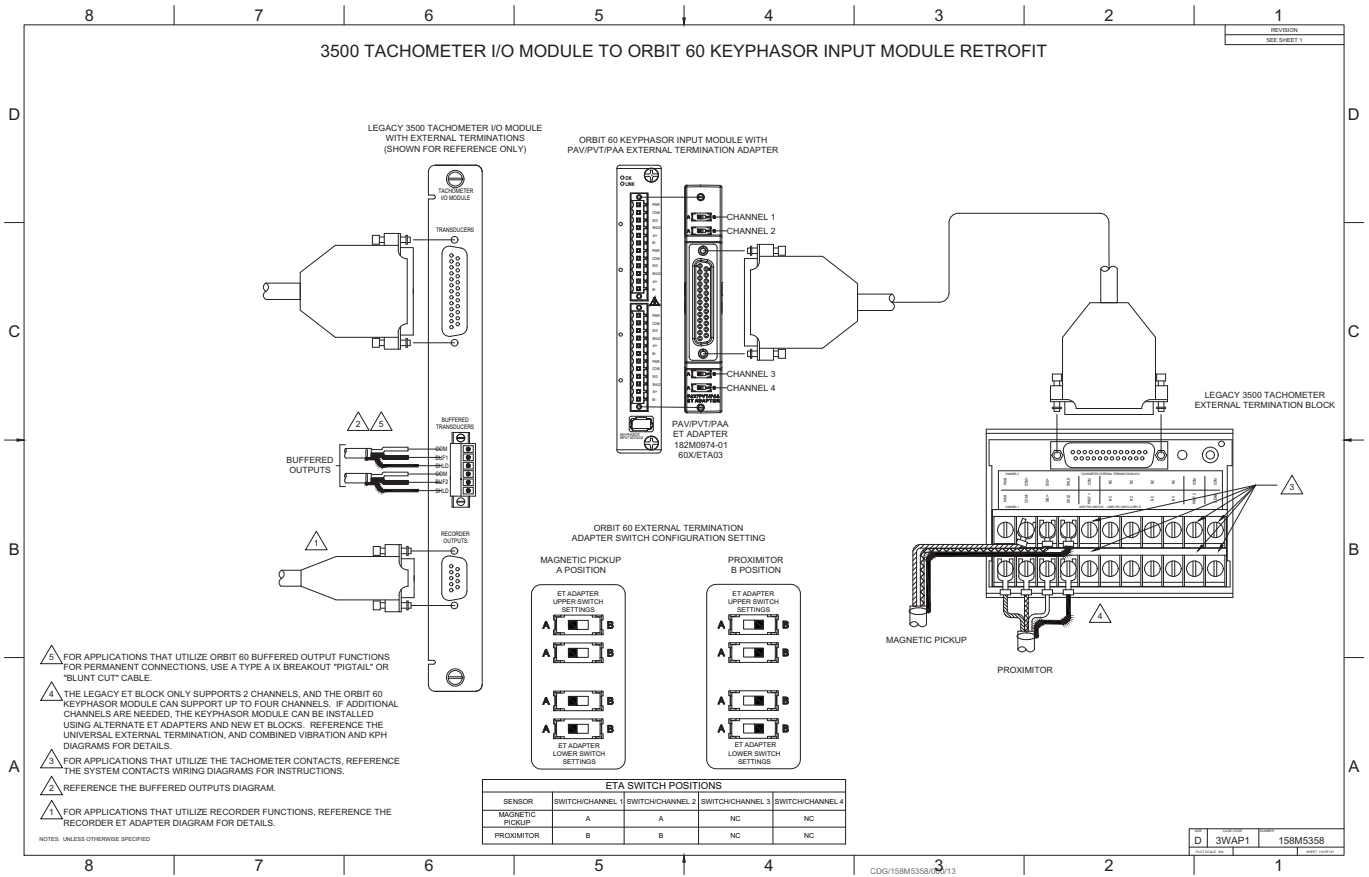


Figure 19: 3500 Tachometer Drawing

Tachometer System Controls

Depending on the application, 3500 tachometer installations had multiple system controls available. Each control switch could be activated using a wired contact as a part of the ET installation through one of the D-sub cables. These controls generally fall under the system contacts discussion. For each system control input that is being actively utilized in an installation, refer to special alarm inhibit section for details in connecting system alarm controls.

Reference [Figure 15: Contact Drawing on page 39](#).

Prox/Velom I/O module

When retrofitting a Prox/Velom I/O, the preferred Orbit 60 input card is the PAV. The specified adapter can be utilized for multiple sensor types, depending on connected sensor, the dip switch settings must be set appropriately.

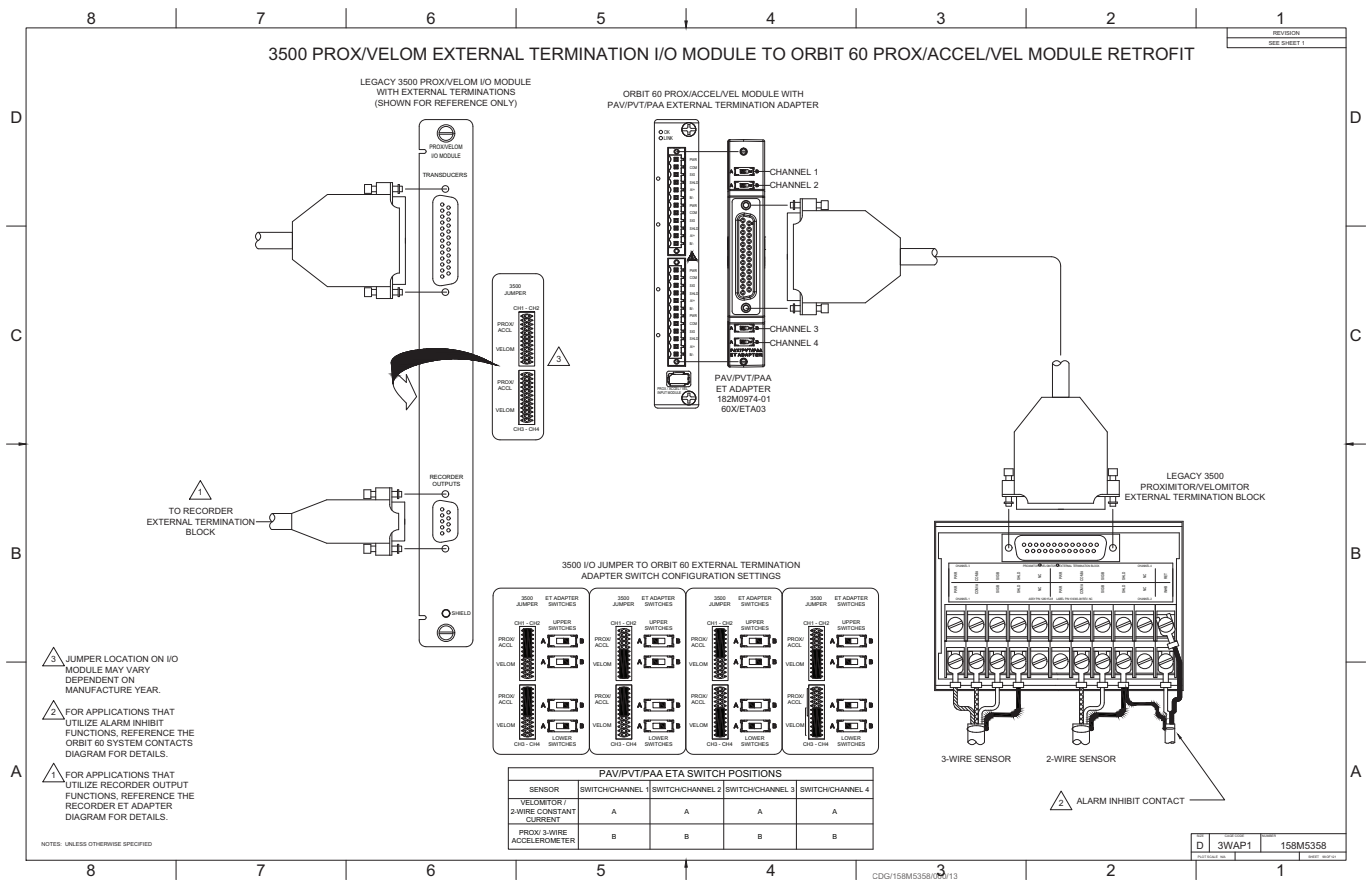


Figure 20: Prox/Velom I/O Drawing

Prox/Velom I/Os could be used for applications requiring special alarm inhibit. Refer to special alarm inhibit section for details in connecting system alarm controls.

Reference [Figure 15: Contact Drawing on page 39](#).

Prox/Seismic I/O Module

When retrofitting a Prox/Seismic I/O, the preferred Orbit 60 input card is the PAS. The specified adapter can be utilized for multiple sensor types, depending on connected sensor, the dip switch settings must be set appropriately.

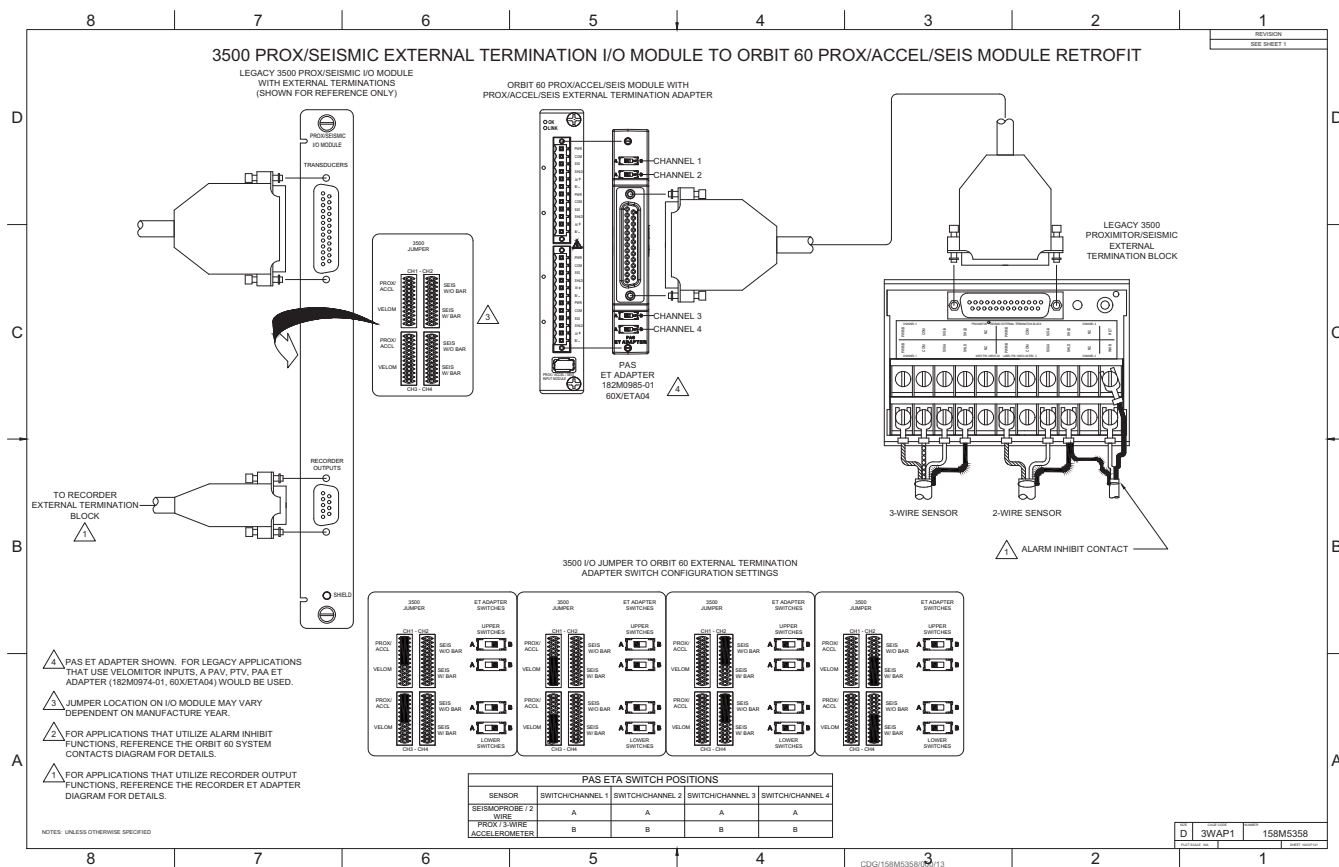


Figure 21: Prox/Seismic I/O Drawing

Prox/Seismic I/Os can be used for applications requiring special alarm inhibit. Refer to special alarm inhibit section for details in connecting system alarm controls.

Reference [Figure 15: Contact Drawing on page 39](#).

Shaft Absolute and Position

Both Shaft absolute and position I/Os (utilizing DC LVDT's) have unique wiring that could not be addressed with an adapter. For these applications the cabling can be left in place, the 3500 external termination block (ETB) must be replaced with the Orbit 60 ETB (60X/ETB01). The field wiring will be re-landed on the new block and the 60X/ETA01 adaptor will be used to connect the cable to the Orbit 60 module.

Shaft Absolute

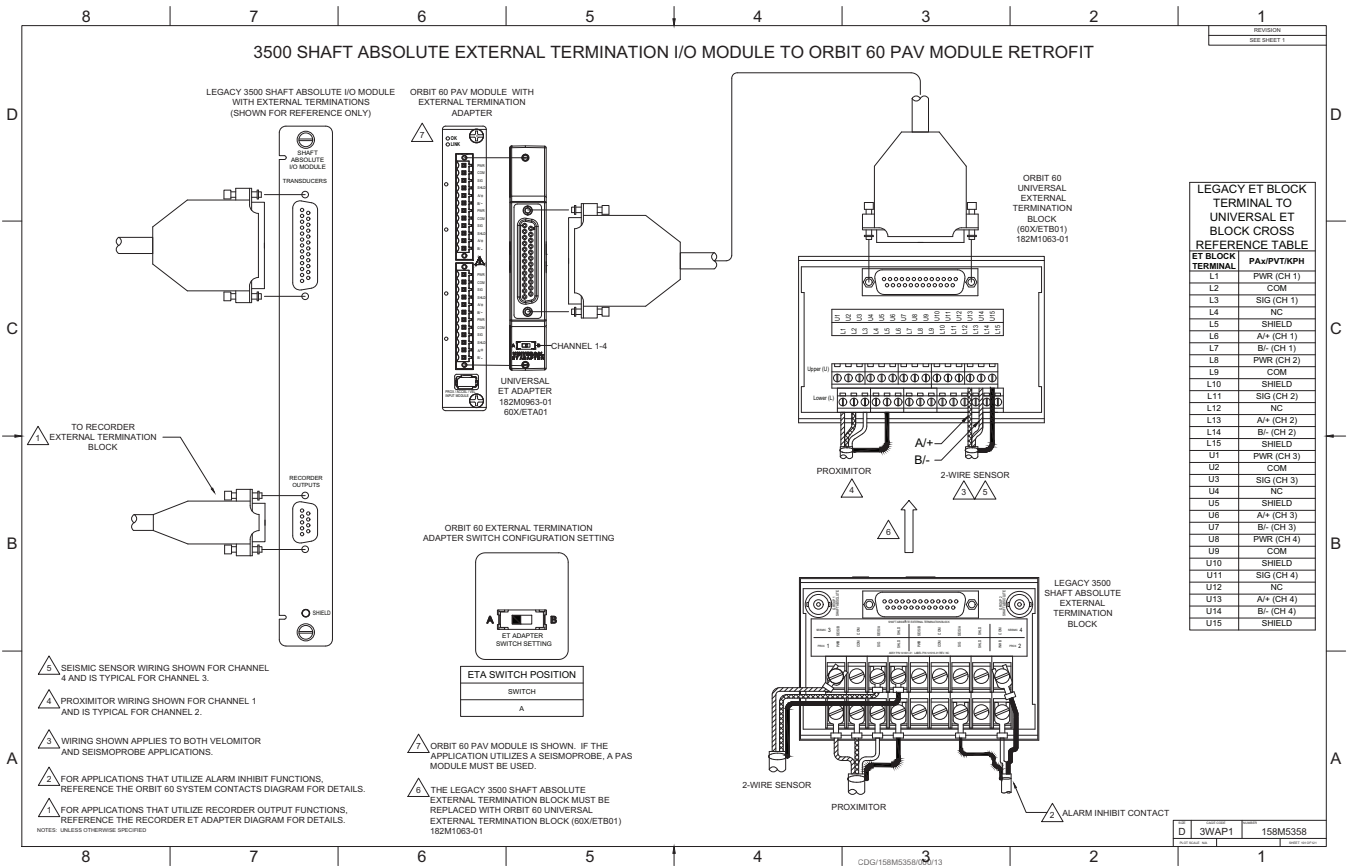


Figure 22: Shaft Absolute Drawing

Position I/O Module

For LVDT connections:

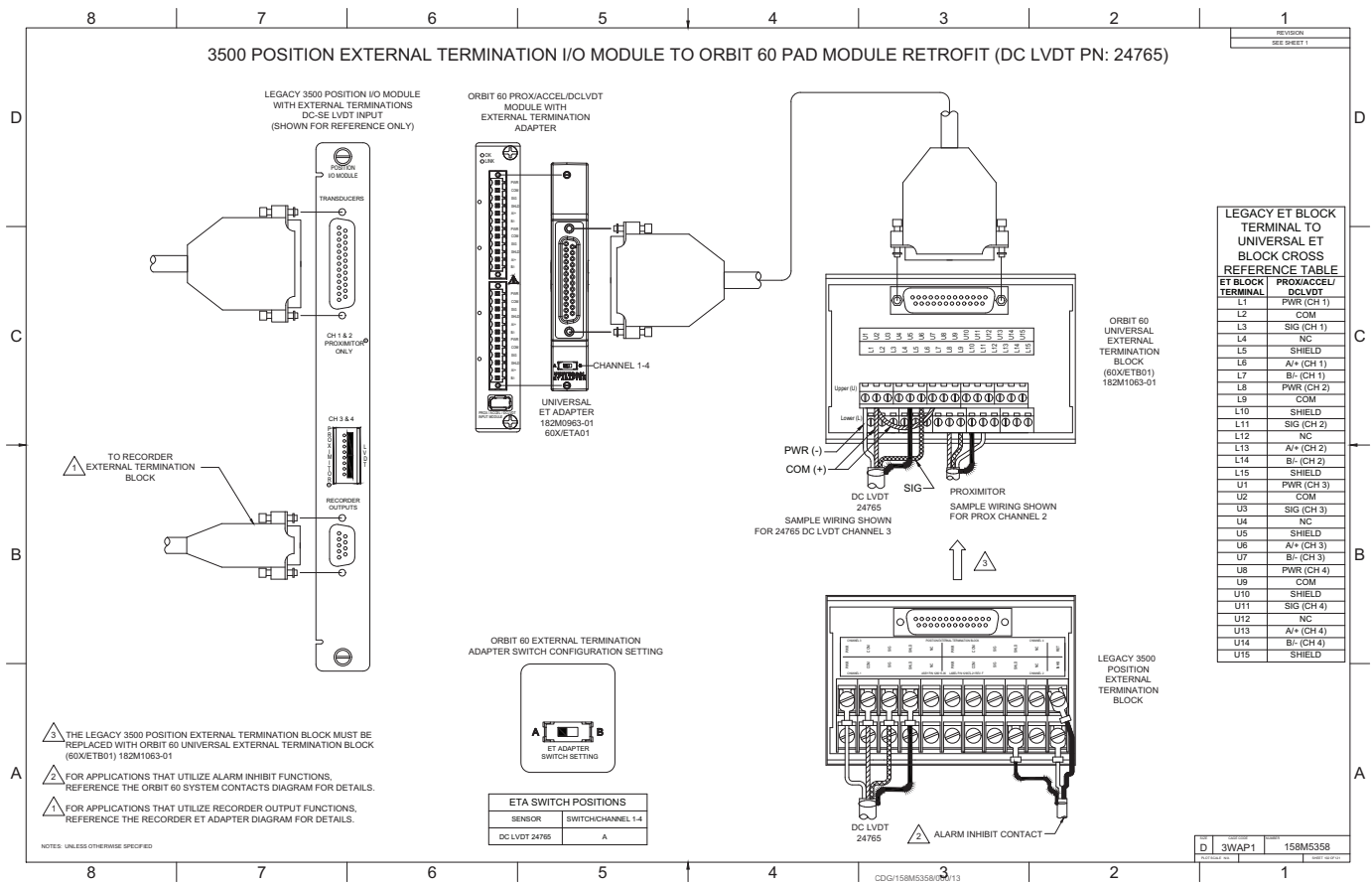


Figure 23: Position I/O Drawing for PN 24765

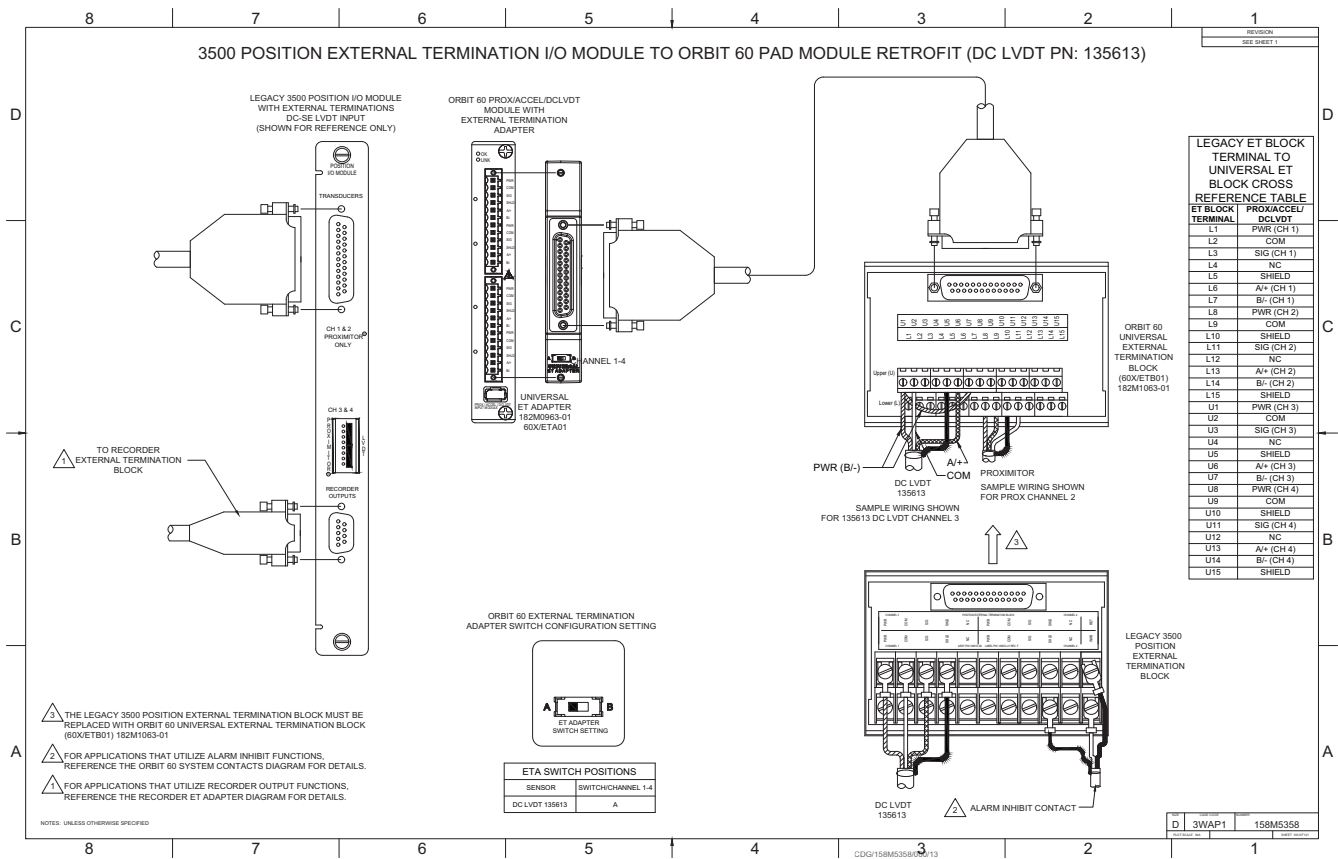


Figure 24: Position I/O Drawing for PN 135613

Position I/Os can be used for applications requiring special alarm inhibit. Refer to special alarm inhibit section for details in connecting system alarm controls.

Reference [Figure 15: Contact Drawing on page 39](#).

ACLVDLT I/O Module

The ACLVDLT module connection will utilize the 60X \ETA02 adapter as shown below.

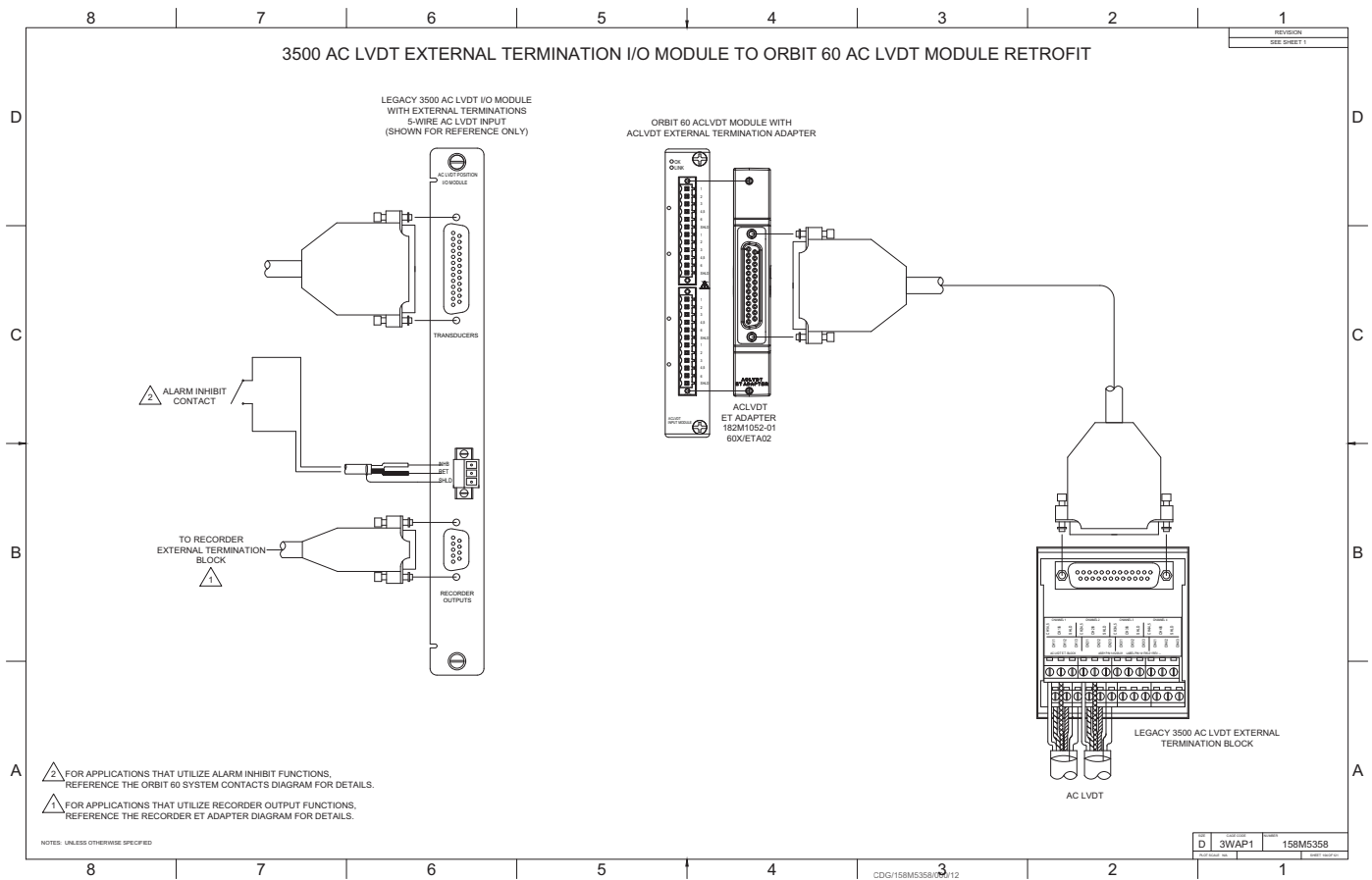


Figure 25: ACLVDT I/O Drawing

ACLVDT I/Os can be used for applications requiring special alarm inhibit. Refer to special alarm inhibit section for details in connecting system alarm controls.

Reference [Figure 15: Contact Drawing on page 39](#).

Cylinder Pressure I/O Module

The Cylinder Pressure module connection will utilize the 60X\ETA03 adapter as shown below. Ensure that the dip switches are positioned correctly.

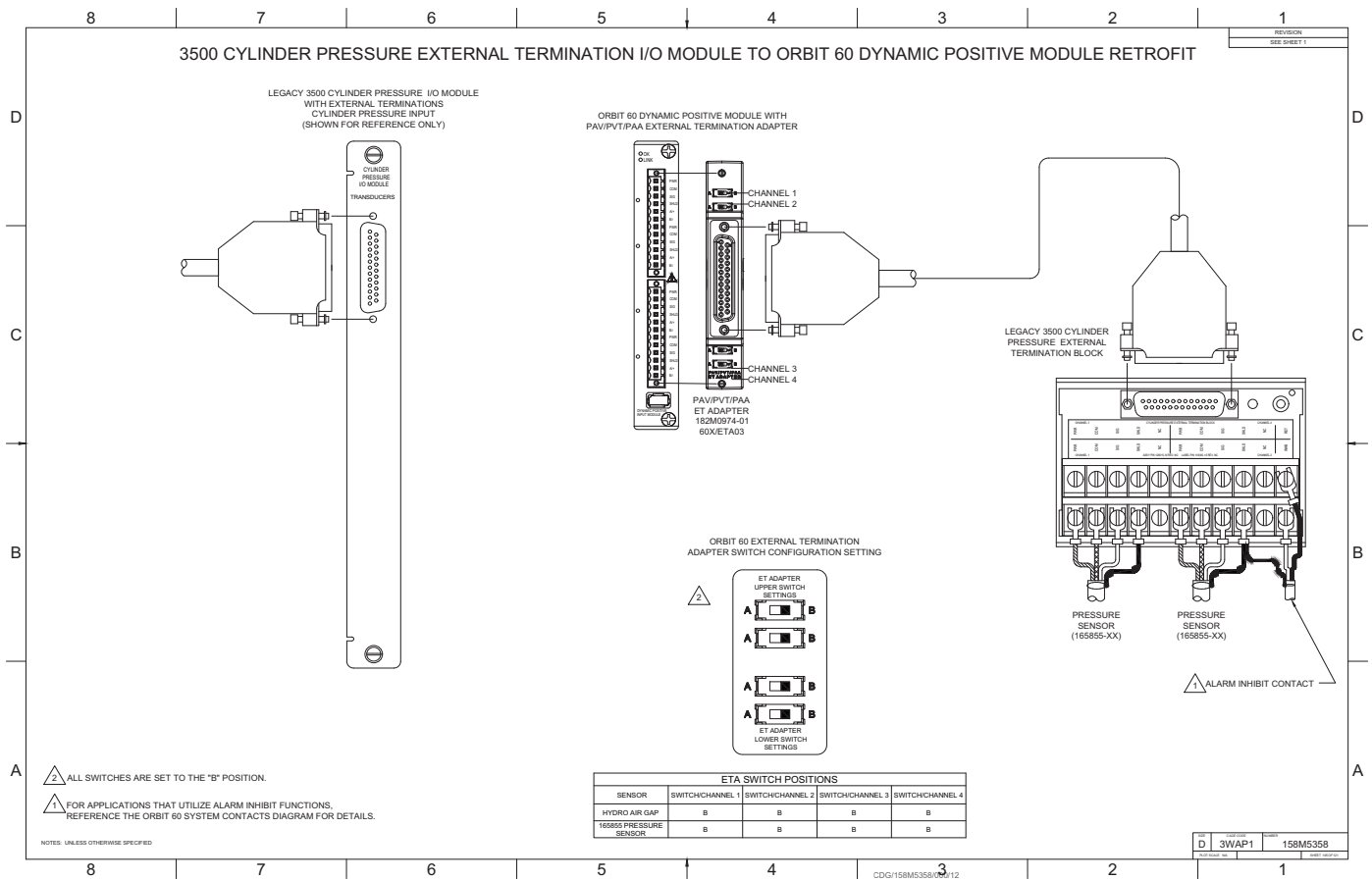


Figure 26: Cylinder Pressure Drawing

±10V Process Variable I/O Module

The voltage input Process Variable module connection will utilize the 60X \ETA06 adapter as shown below.

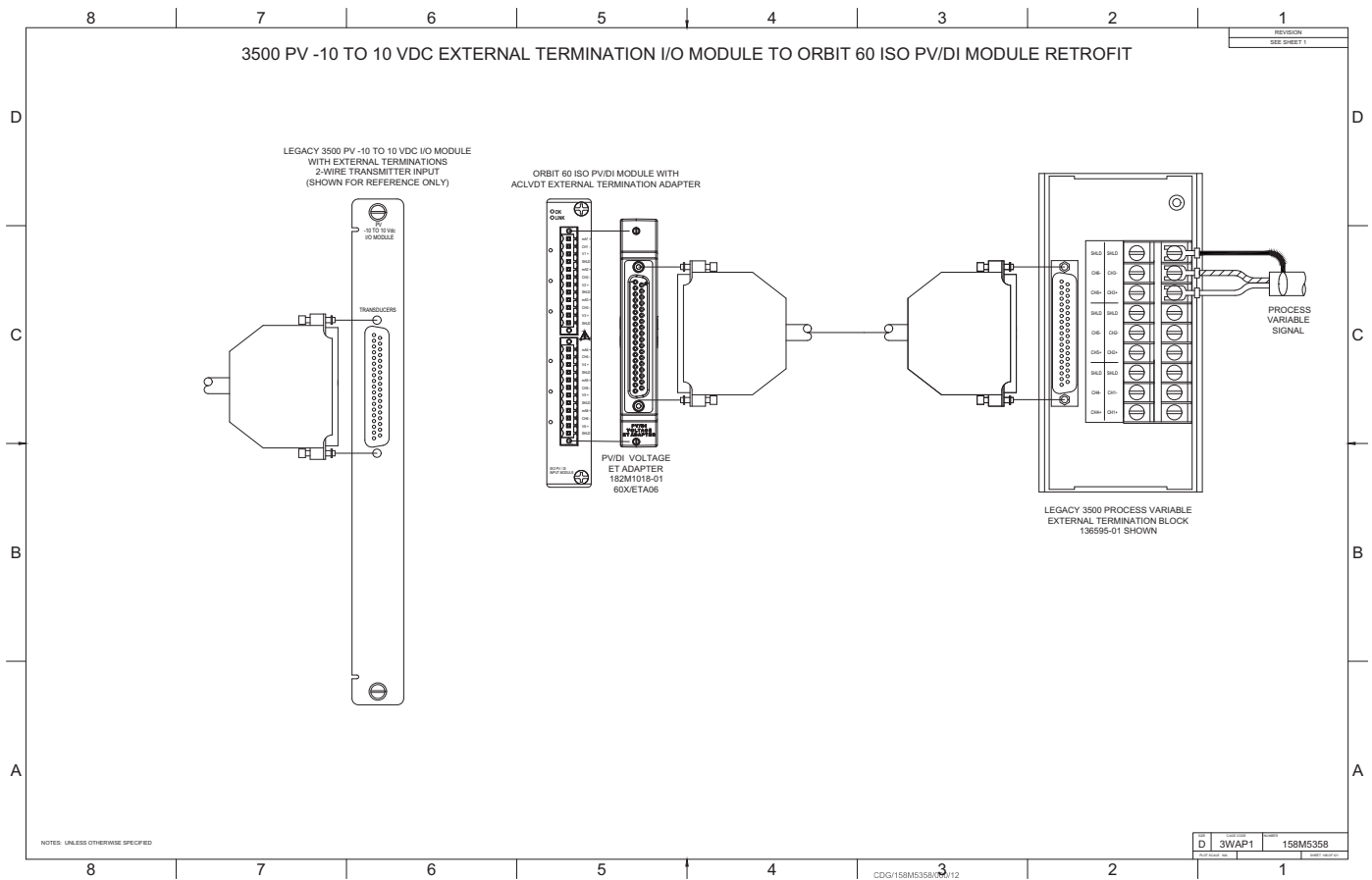


Figure 27: ±10V PV Drawing

4-20 mA PV I/O Module

The current detecting Process Variable module connection will utilize the 60X\ETA07 adapter as shown below.

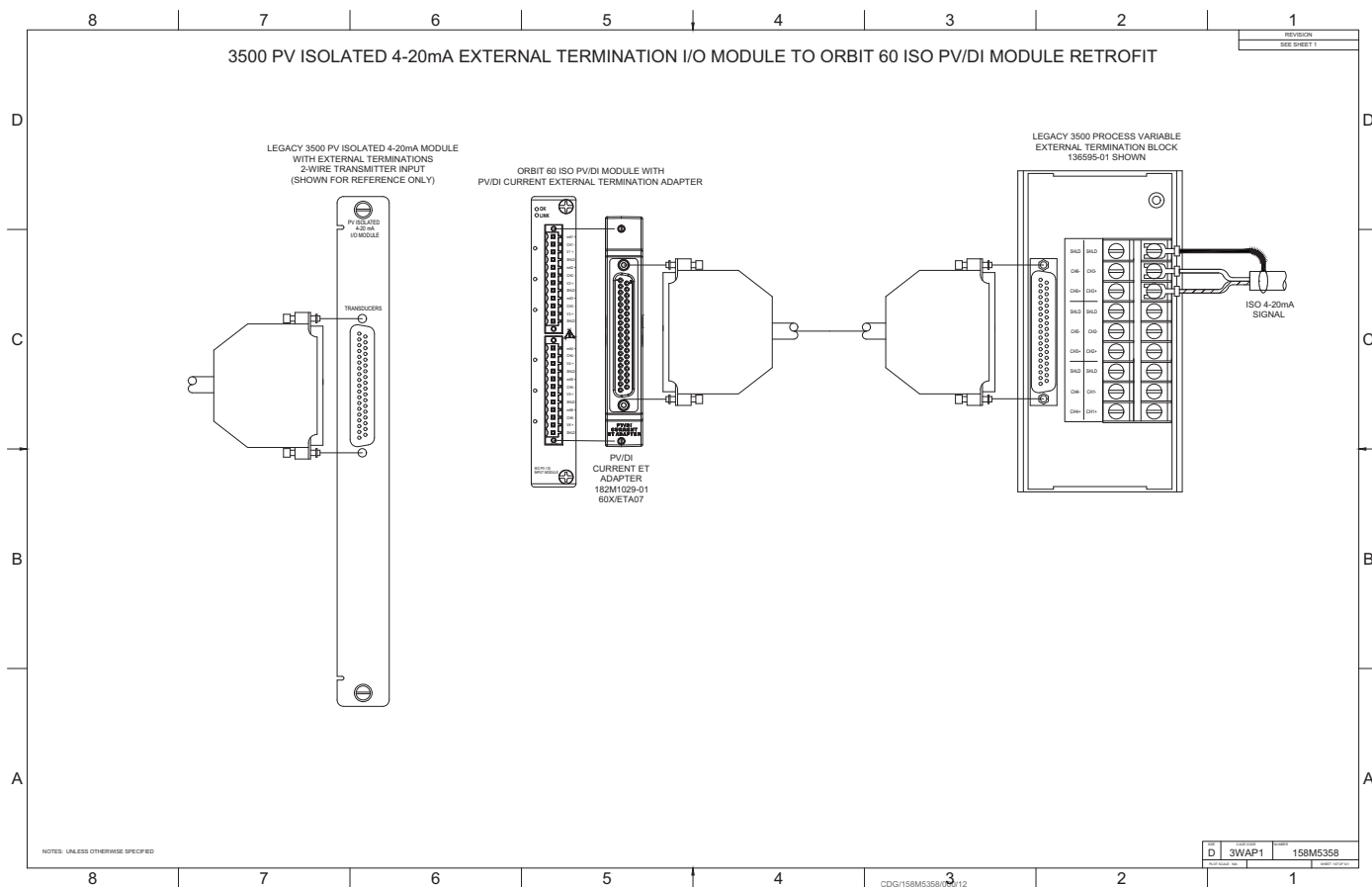


Figure 28: 4-20 mA PV I/O Drawing

Dynamic Pressure I/O Module

The Cylinder Pressure module connection will utilize the 60X\ETA03 adapter as shown below. Verify the position of the jumpers in the 3500 I/O module and ensure that the dip switches are positioned correctly.

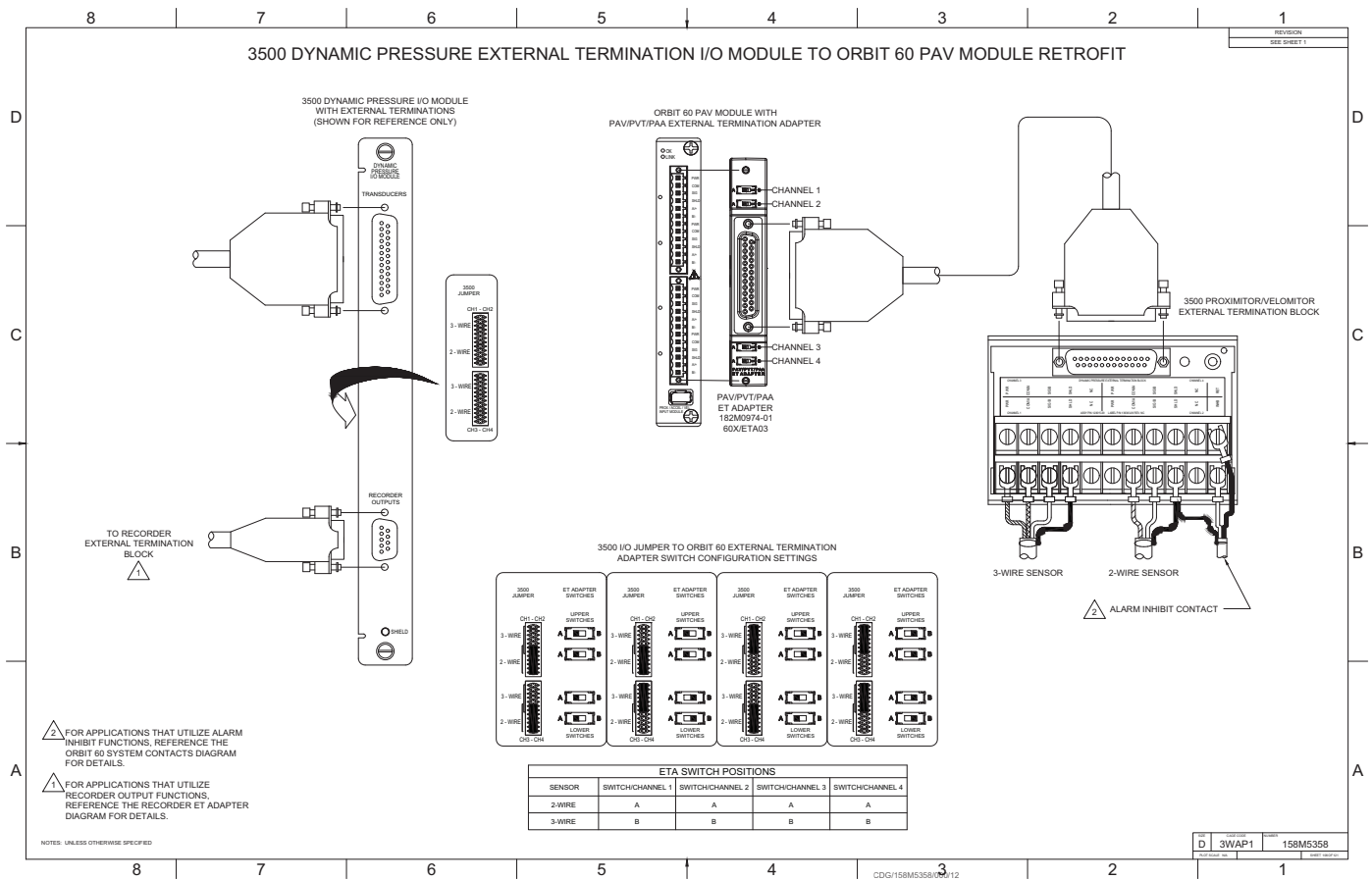


Figure 29: Dynamic Pressure Drawing

Dynamic pressure I/Os can be used for applications requiring special alarm inhibit. Refer to special alarm inhibit section for details in connecting system alarm controls.

Reference [Figure 15: Contact Drawing on page 39](#).

TC/RTD, TC/RTD w/Recorder I/O Modules (RTD CONNECTIONS ONLY)

There are multiple scenarios to consider when retrofitting 3500 installations that utilize temperature inputs.

- **16 channel 3500 temperature cards:** Regardless of transducer type, Orbit 60 only allows a 6 channel temperature card, any 16 channel retrofit must be split across multiple Orbit 60 temperature cards. This requires the replacement of both the 37 pin D-Sub cable and the ET block used for 3500 with appropriate 25 Pin cabling and universal (60X/ETB01) ETB/ETA combination in quantities to support the channels.
- **3 Wire RTDs:** Handled through direct application of an appropriate adapter combined with management of channel count mismatches described above.
- **4 Wire RTDs:** Not directly supported in Orbit 60. If necessary, the 4 wire sensor can be wired as a 3 wire sensor per the field wiring diagrams.

- **Thermocouples:** If any temperature transducer connected to a particular 3500 module is a thermocouple then a special Orbit 60 temperature module must be utilized to allow for correct cold junction compensation. Cold junction compensation (CJC) must be done where the field wiring is landed so a dedicated external termination input card combined with an Orbit 60 specific ET block that includes CJC must be utilized. In these cases, the following guidelines apply:
 - Must utilize specially designed Orbit 60 Input card and Orbit 60 TC specific ET block in conjunction with a standard 3500 27 pin D-Sub cable.
 - This combination of card, cable, and block can also support RTDs.

6 Channel 3500 Temperature Input with RTD Only

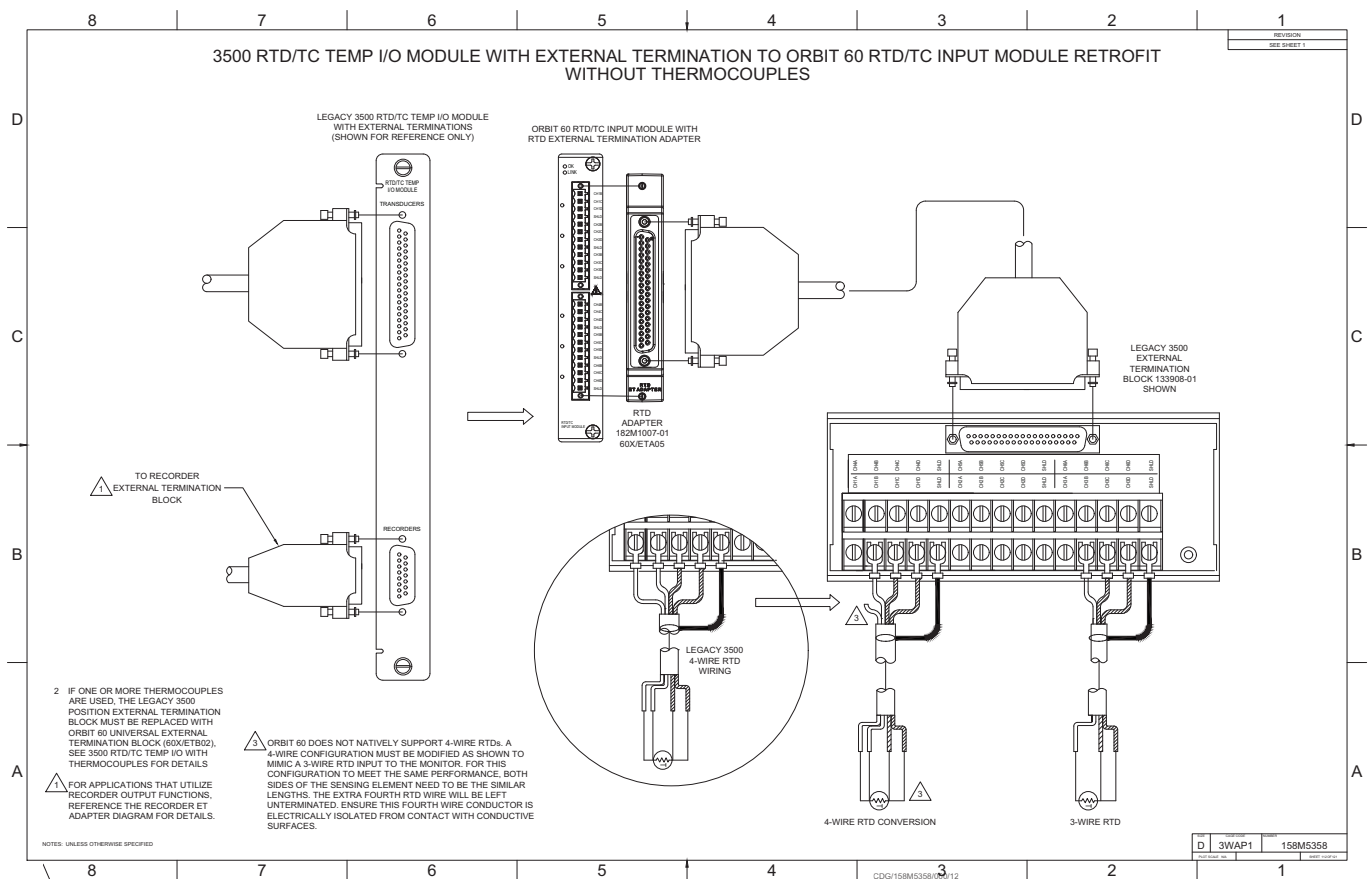


Figure 30: 3500 Temperature RTD Only Drawing

RTD TC I/O Modules with One or More Thermocouples

All thermocouple connections require that cold junction compensation (CJC) of the signal occurs at the field wiring termination location. This CJC occurs on the ETB block rather than in the I/O module itself. External terminations must utilize separate Orbit 60 modules to allow for this, since Orbit 60 utilizes different components than 3500, the 3500 ETB block must also be replaced with an Orbit 60 thermocouple ETB (60X/ETB02). This note does not apply for RTD temperature sensors; only thermocouple installations require the new ETB and input module.

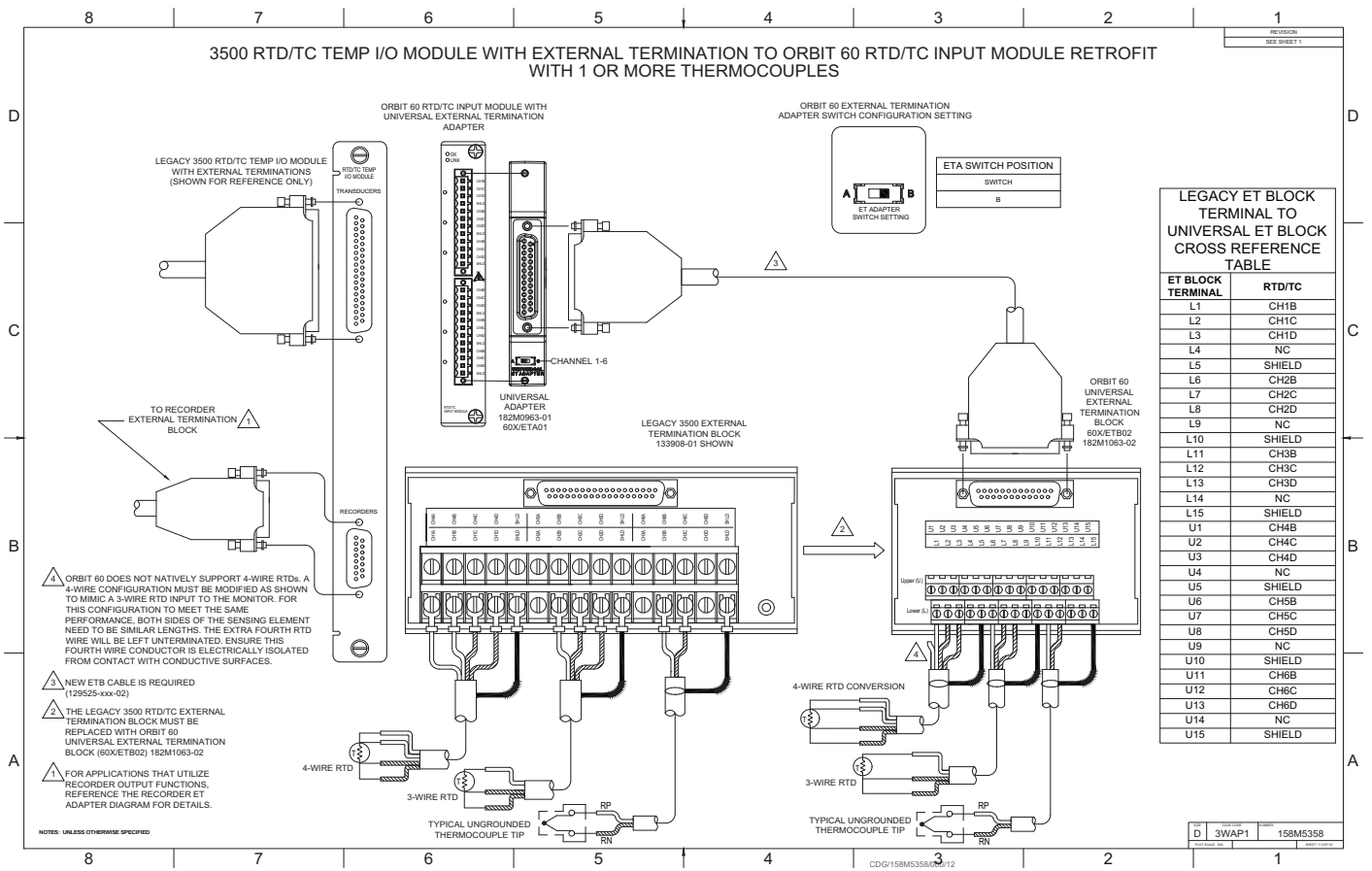


Figure 31: RTD TC I/O Modules Drawing

16 Channel RTD/TC

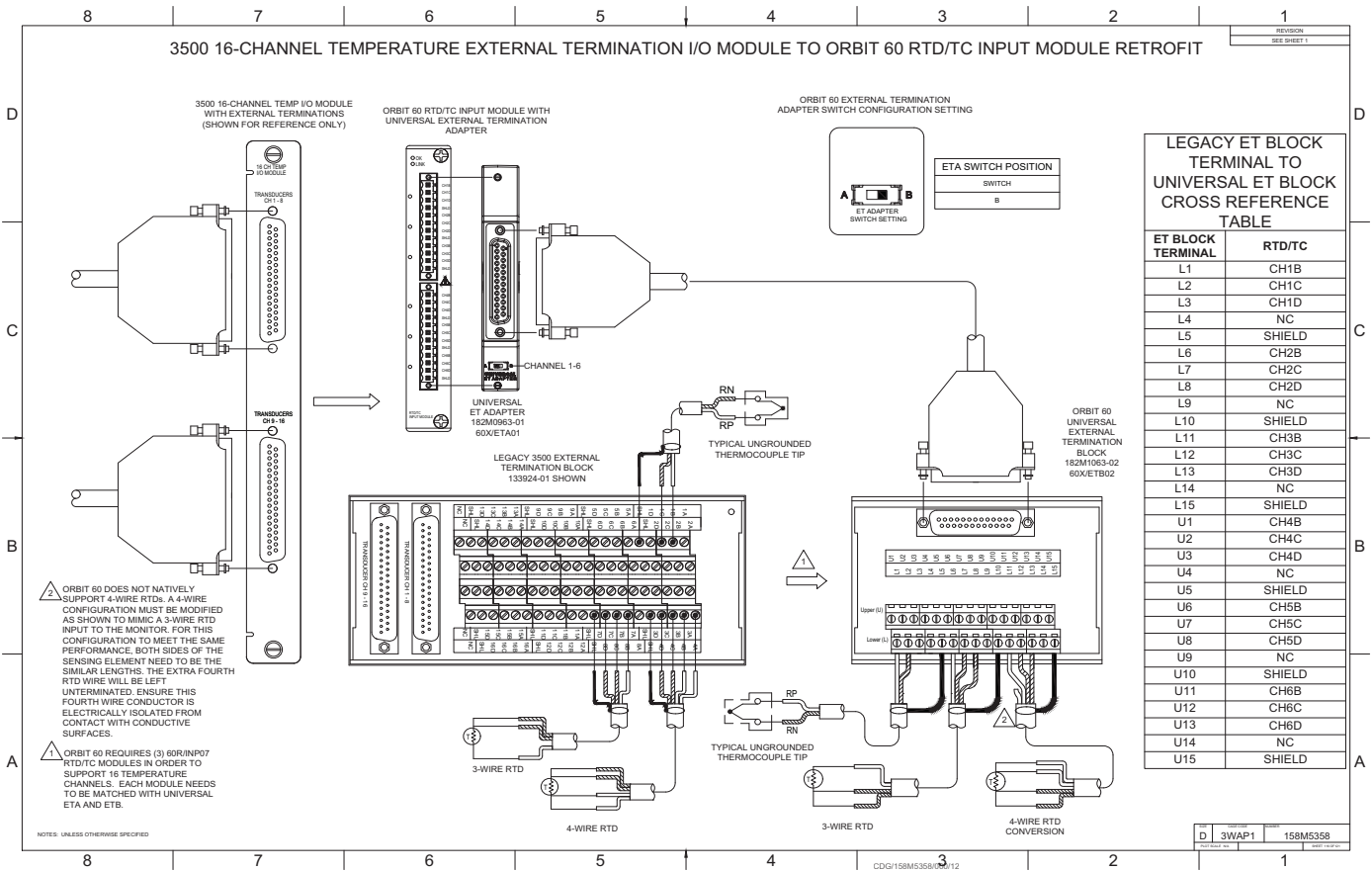


Figure 32: 16-Channel RTD Drawing

Isolated TC I/O Modules

All thermocouple connections require that cold junction compensation (CJC) of the signal occur at the field wiring termination location. For all external termination installations this CJC occurs on the ETB block rather than in the I/O. External terminations must utilize external termination specific Orbit 60 modules to allow for this, since Orbit 60 CJC utilizes different components than 3500, the 3500 ETB block must also be replaced with an Orbit 60 thermocouple ETB (60X/ETB02).

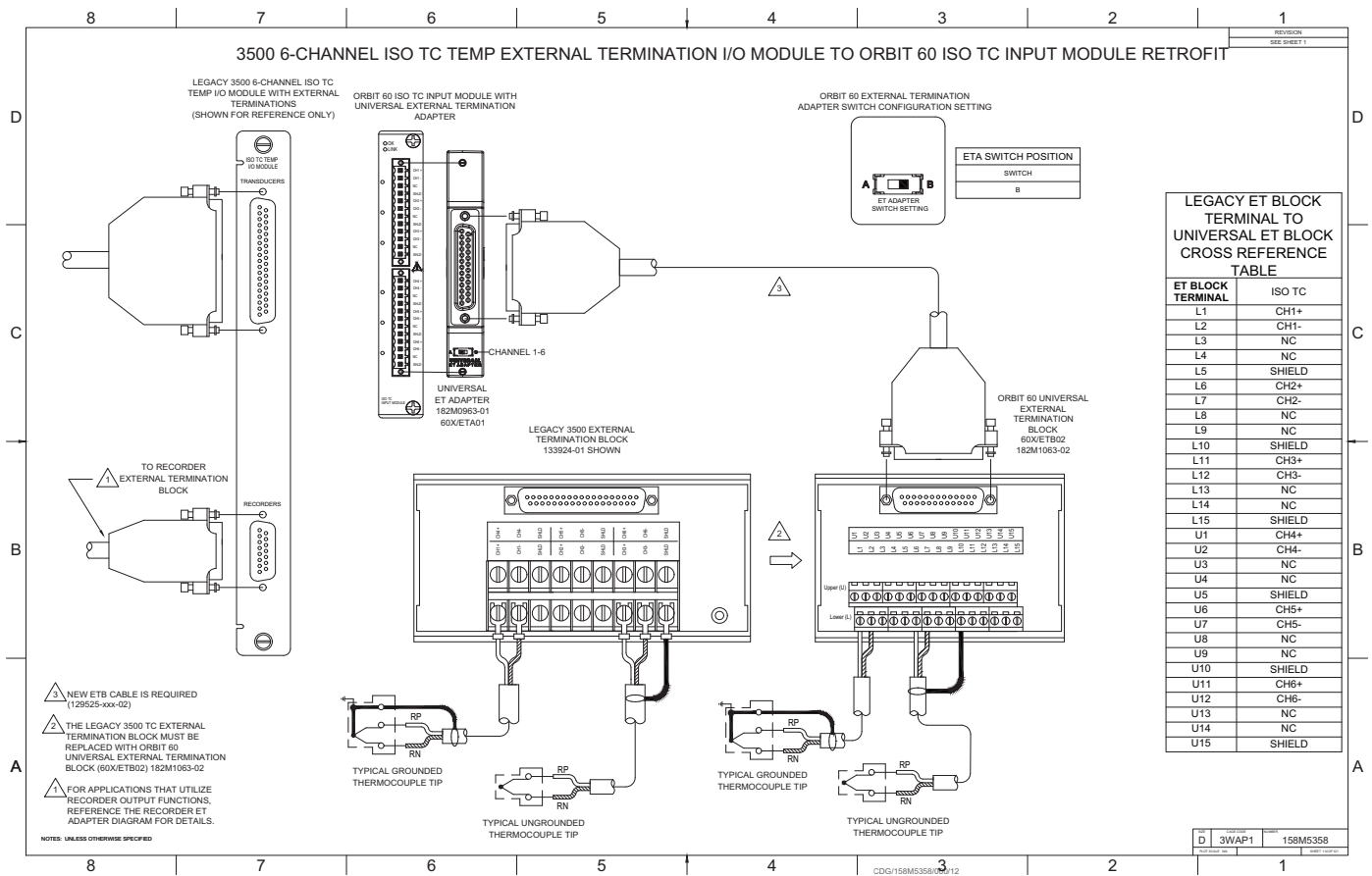


Figure 33: Isolated TC I/O Drawing

Recorder Output Connection on Temperature Monitors

Recorder connections for temperature modules require a complete replacement for use with Orbit 60, the 15 pin ETB cable and associated ET block supported by 3500 is not supported by Orbit 60.

Due to mismatch in transducer connection allowed per module between 3500 and Orbit 60, the connections must be separated into blocks that can be connected to a single Orbit 60 input module. Recorder outputs for Orbit 60 are 8 channels per card. When retrofitting 3500 temperature monitors with recorder outputs, the 6 channel recorder outputs does not scale directly to Orbit modules. To address this, 3500 ETBs in these applications must be replaced by an appropriate number of Orbit 60 universal 24 connector ET blocks (60X/ETB01) and associated 25 pin cables.

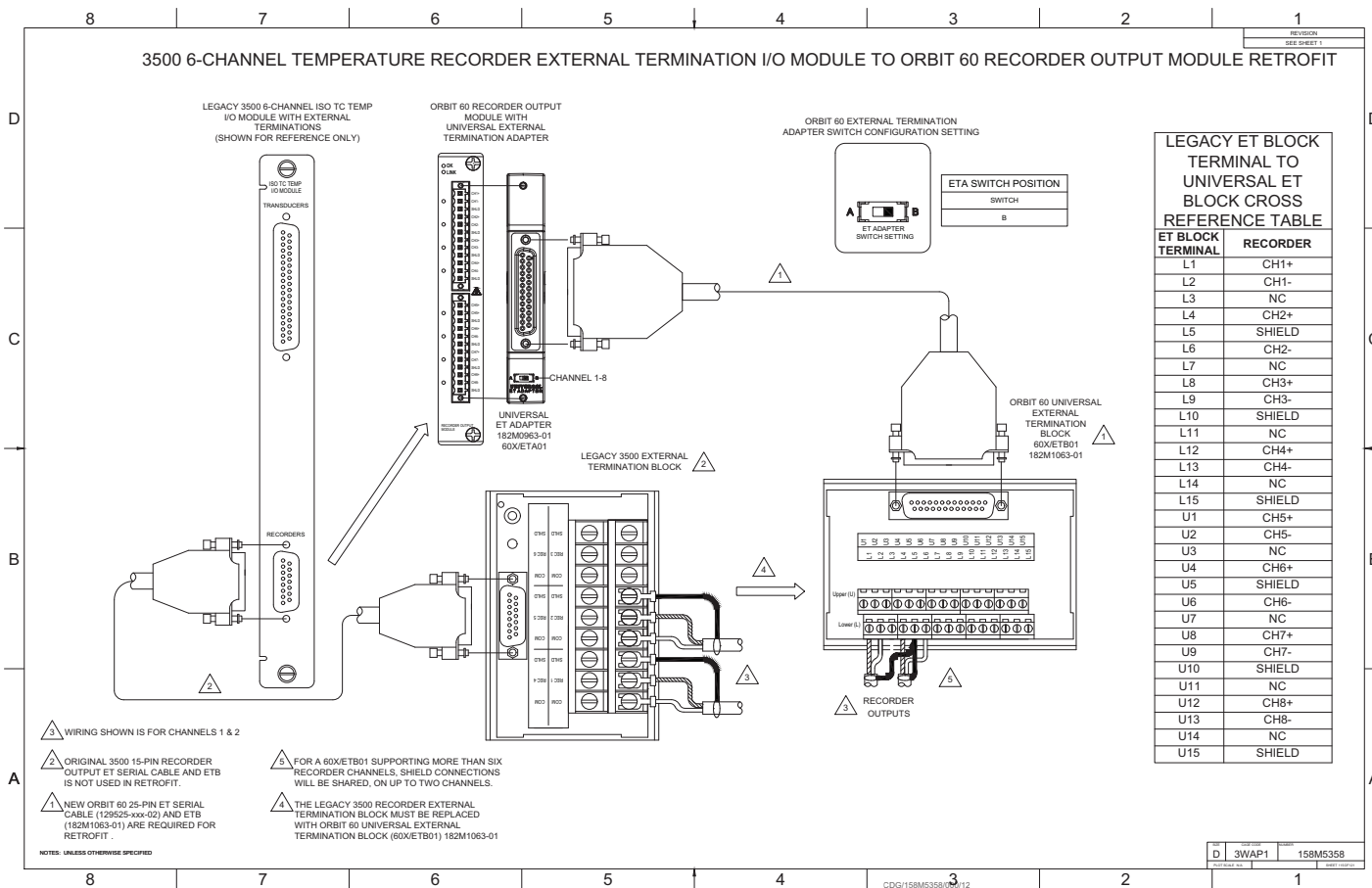


Figure 34: Recorder Output Drawing

Aero GT I/O Module

Aero GT applications are supported by the appropriate adapter as shown.

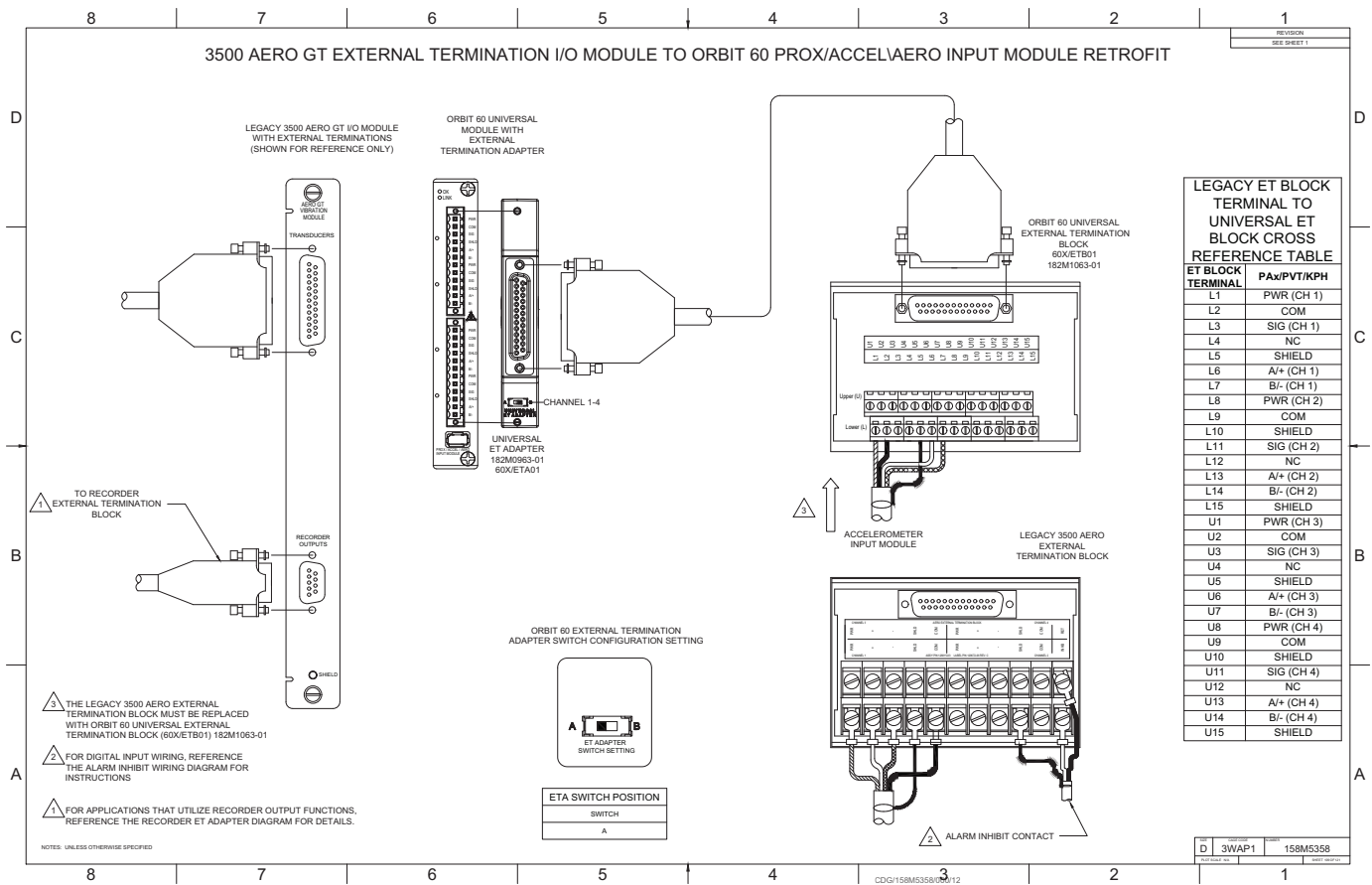


Figure 35: Aero GT Drawing

Multimode Prox/Velom I/O Module

The Multimode Prox/Velom module connection will utilize the 60X\ETA01 adapter as shown below. Verify the position of the jumpers in the 3500 I/O module and ensure that the dip switches are positioned correctly.

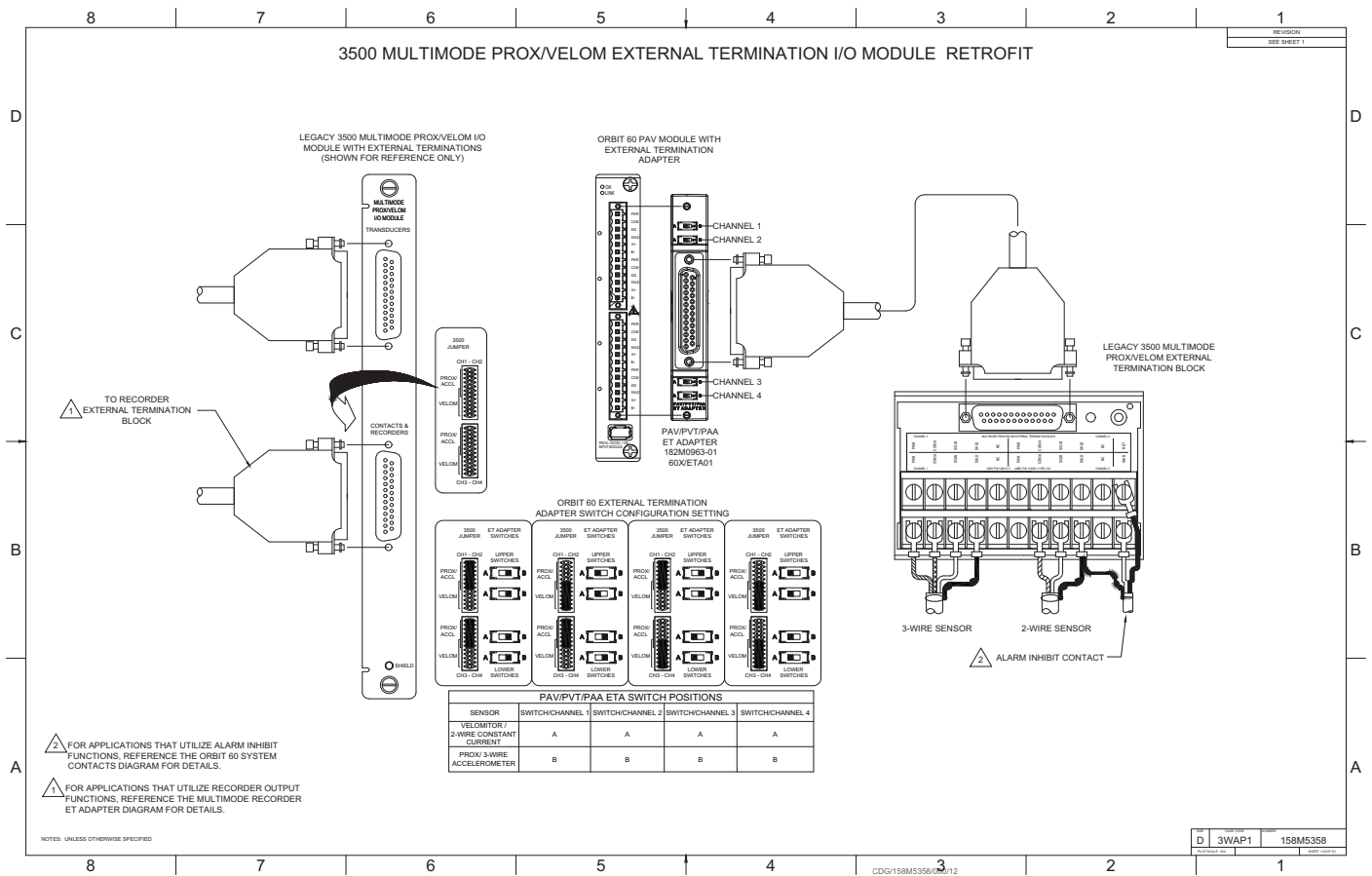


Figure 36: 3500 Multimode Drawing

Multimode Contacts and Recorder Connection on Multimode I/O Modules

Recorder connections for multimode I/O modules must replace the 3500 ET block with the Orbit 60 universal ET block (60X/ETB01) to connect the field wiring correctly.

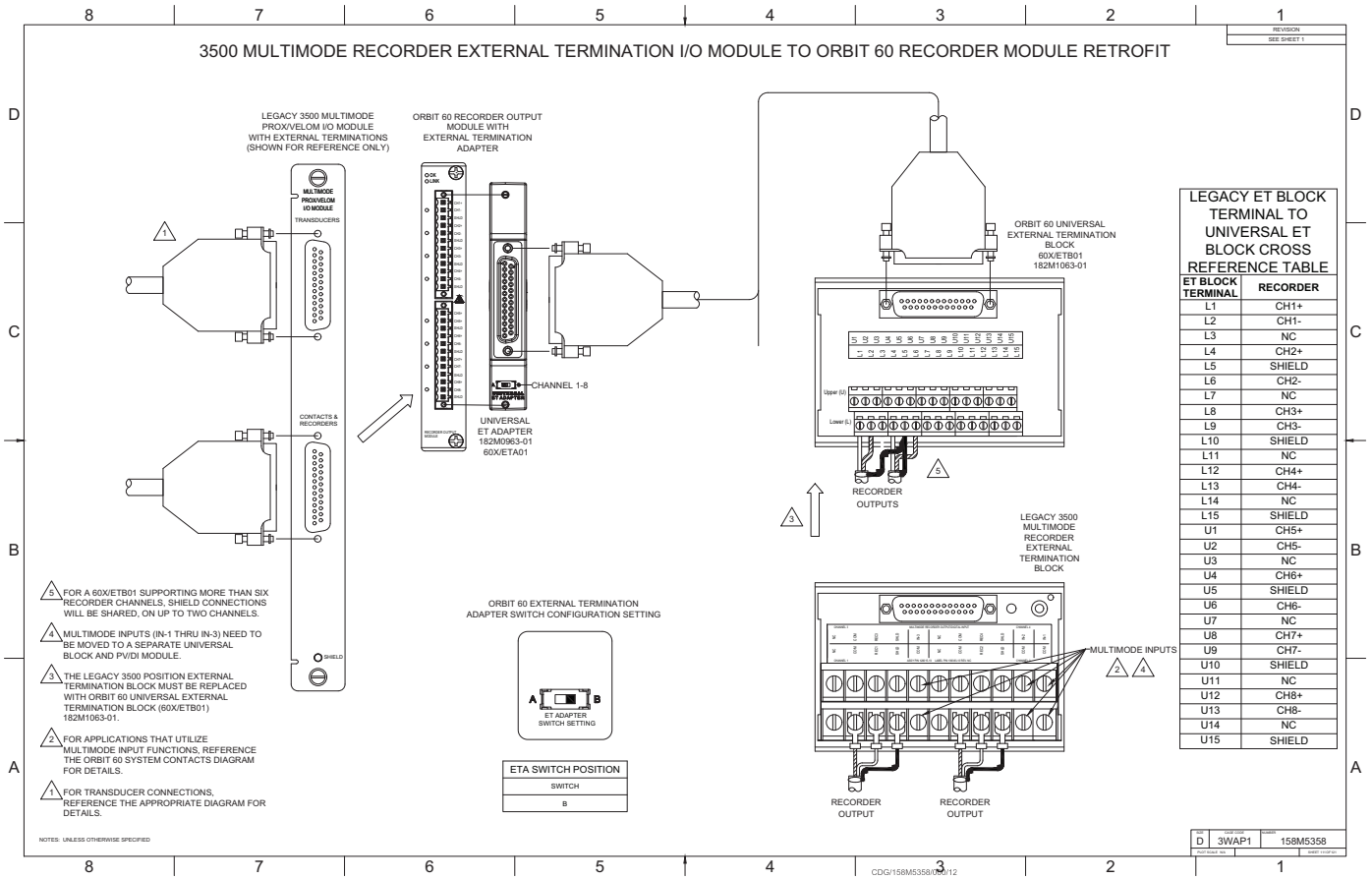


Figure 37: Multimode Contacts Drawing

If the multi-mode contacts are used in the application then the System Contacts drawing ([Figure 15: Contact Drawing on page 39](#)) should be followed.

13. Transducers

It is Bently Nevada's recommendation that any 3500 installation connected to sensors that are more than 15 years old should have the transducers replaced as part of the upgrade. 3000 series proximitors are not supported within the Orbit 60 platform.

Table 10: Supported Transducers by Input Module

Input Module Type	Supported Transducer Types	Number of Channels
PAV Negative Dynamic Sampler (Prox, Accel, Velom)	3-wire (-) Accel 3-wire (-) Prox 2-wire Velomitor 2-wire IEPE	4
PAS Negative Dynamic Sampler (Prox, Accel, Seismic)	3-wire (-) Accel 3-wire (-) Prox Seismoprobe	4
PAA Negative Dynamic Sampler (Prox, Accel, Aero)	3-wire (-) Accel 3-wire (-) Prox HTVAS Acceleration Interface Module	4
PAD Negative Dynamic Sampler (Prox, Accel, DC LVDT)	3-wire (-) Prox 3-wire (-) Accel DC LVDT	4
PVT Positive Dynamic Sampler (Prox, Accel, Velom)	3-wire (+) Accel 3-wire (+) Prox 2-wire IEPE	4
High Speed Keyphasor (KPH)	3-wire Accel 3-wire Prox Magnetic pickup	4
AC LVDT Input	4-wire AC LVDT 5-wire AC LVDT	4
RTD / TC Input	Type J, K, E, T 3-wire RTD	6
Isolated Discrete Input /Process Variable	4-20 mA -10 V to +10 V Dry/wet contacts	6



Four wire RTDs are not supported in the Orbit 60 system. These devices will have to be wired into Orbit 60 as 3 wire RTDs.

14. Glossary of Terms

Accel	Acceleration
Aero	Aeroderivative
API	American Petroleum Institute
BRG	Bridge
BTO	Buffered Transducer Output
CE	Case Expansion
CGW	Communication Gateway Module
CIDE	Complementary Input Differential Expansion
CMM	Condition Monitoring Module
COM	Common
DCM	Distributed Condition Monitoring
DCS	Distributed Control Systems
DR(DE)	Dual Ramp (Differential Expansion)
EGD	Ethernet Global Data
ESD	Emergency Shutdown Device
ETA	External Termination Adapter
ETB	External Termination Block
EIA	Energy Information Administration
EMR	electromechanical Relay
HAZLOC	Hazardous Location
HTVAS	High Temperature Velocity/Accel Sensor
I/O	Input/Output
IEPE	Integrated Electronics Piezo-Electric
ITC	Isolated Thermocouple
KPH	High Speed Keyphasor
LVDT	Linear Variable Differential Transformer
NC	Normally Closed
NEMA	National Electrical Manufacturers Association
NO	Normally Opened
NSSRDE	Non-Standard Single Ramp Differential Expansion
NTP	Network Time Protocol
OEM	Orginal Equipment Manufacturer
PAA	Prox, Accel, Aero

PAD	Prox, Accel, Displacement Module
PAS	Prox, Accel, Seismic
PAV	Prox, Accel, Velom
PIM	Power Input Module
PLC	Programmable Logic Controller
PPM	Protection Processing Module
Prox	Proximity
PVD	Isolated Process Variable, Discrete Input
PVT	Positive Voltage Transducer
REB	Roller Element Bearing
REC	Recorder Outputs
RMC	Remote Monitoring Center
RST	Reset
RTD	Resistance Temperature Detector
SAI	System Alarm Inhibit
SCDE	Single Channel Differential Expansion
SHLD	Shield
SIL	Safety Integrity Level
SIM	System Interface Module
SSR	Solid State Relay
SSRDE	Standard Single Ramp Differential Expansion
SW	Software
TC	Thermocouple
TLS	Transport Layer Security
RTD/TC	Resistance Temp Detector / Thermocouple
TCP/IP	Transmission Control Protocol Internet Protocol
TM	Trip Multiply
OEM	Orginal Equipment Manufacturer
Velom	Velomitor

Copyright 2026 Baker Hughes Company. All rights reserved.

Bently Nevada, a Baker Hughes Company
1631 Bently Parkway South, Minden, Nevada USA 89423

<https://bntechsupport.com>