Telecommunications Group

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Span Termination System (STS) Installation and Application Engineering

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1. GENERAL

1.1 Document Purpose

This section provides installation and application information for the Charles Industries Span Termination System (STS), including complete descriptive information on the following STS Shelf Assemblies:

- 3192-11 23” Connectorized Mounting Shelf.
- 319-02 19” Connectorized Mounting Shelf.
- 3192-WR 23” Wirewrap Mounting Shelf.
- 319-04 19” Wirewrap Mounting Shelf.

1.2 Document Status

This document is reprinted to add new 319–02 issue 3 19” connectorized mounting shelf information and to add general editorial updates.

1.3 Equipment Function

The Charles Industries Span Terminating System (STS) is a flexible, feature-rich T1 Terminating System in a compact package. The 23” mounting shelves can be equipped with up to 28 span powering office repeaters, matching the capacity of DS3 lightwave multiplexer systems. The 19” mounting shelves provide 22 repeater positions.

For a descriptive overview of the STS System shelf assemblies and plug-in modules, refer to Section 319-211-10X Span Termination System (STS) General Description. For more information about installing and optioning the plug-in modules, refer to the documents listed in NO TAG.

Table 1. STS System Documentation

Section #	Description	Section #	Description
319-211-10X	STS General Description	319-27F-20X	STS 3192-7F Powering Office Repeater with Addressable Loopback
319-29B-20X	STS 3192-9B Bridging Office Repeater	319-2FL-20X	STS 3192-FL Fault Locate Module
319-29L-20X	STS 3192-9L Automatic Span Regulator (ASPR) Powering Office Repeater	319-2OW-20X	STS 3192-OW Order-Wire Module

Section #	Description	Section #	Description
319-29M-20X	STS 3192-9M Automatic Span Regulator (ASPR) Powering Office Repeater	319-29C-20X	STS 3192-9C Cut-Thru Module
319-29P-20X	STS 3192-9P Short Loop Office Repeater	319-29F-20X	STS 3192-9F Alarm Module
319-29T-20X	STS 3192-9T Terminating Office Repeater	319-29E-20X	STS 3192-9E Powering T1 Network Interface Unit (NIU)

Note: X = product Issue level

2. INSPECTION

2.1 Inspect for Damages

Inspect the equipment thoroughly upon delivery. If the equipment has been damaged in transit, immediately report the extent of damage to the transportation company.

2.2 Equipment Identification

Charles Industries' equipment is identified by a model and issue number imprinted on the front panel or located elsewhere on the equipment. Each time a major engineering design change is made on the equipment, the issue number is advanced by 1 and imprinted on subsequent units manufactured. Therefore, be sure to include both the model number and its issue number when making inquiries about the equipment.

3. APPLICATION ENGINEERING

3.1 General

The STS is ideally suited to provide T1 span extensions from outside plant cabinets, huts and CEV's that are fed on fiber facilities. These T1 spans can feed downline loop carrier systems or can be used to provide customer DS1 service. The STS System can also be used at lightwave fed RT sites located at customer premise locations for distributing DS1 services within a building.

STS Shelf Assemblies are available in various configurations for miscellaneous mounting in outside plant cabinets, huts, CEV's and standard 23" and 19" rack assemblies. Dedicated Central Office or CEV equipment frames can provide up to 224 powering office repeaters in a single 7' X 23" frame.

All STS plug-in modules and assemblies are fully qualified to operate over a –40°F to 149°F (–40°C to 65°C) ambient temperature range and can tolerate up to 95% RH (without condensation). All system elements operate from a standard –42.5 to –56VDC source.

3.2 T1 Digital Line Design, Repeated Spans

The STS System supports T1 digital spans operating at 60mA. Provision is made for bidirectional span powering only. The design of the T1 span, including repeater spacing and cable pair selection, should be done according to standard T1 span design or local company practice. Bell Operating Companies can use the DILEP II System described in Bellcore Practice BR-902-200-120 to facilitate this task.

The STS family provides several types of line powering, terminating, and bridging office repeaters. Selection of the proper plug-in is dependent upon application. Refer to Table 3 for features of the various STS System plug-in modules.

Repeatered spans can use either the 3192-9L, 3192-7F, or 3192-9M line powering repeaters. The 3192-9L and 3192-7F provide either –130 or ±130V (260V total) maximum span voltage on a switch selectable basis. The 3192-9M provides –130V only.

The 3192-9L and 3192-9M will regenerate incoming signals that have experienced up to 35dB of loss. The 3192-9L Issue 3 accommodates this loss via an internal ALBO circuit and a switchable 7.5dB pad. The 3192-9L Issue 4 and 3192-9M Issue 1 provide a wide range ALBO that can accommodate incoming signals that have experienced from 0 to 35dB of loss. No 7.5dB pad is required or necessary on these modules.

The 3192-9L Issue 3 provides a transmit side LBO (Line Build Out) which consists of three cascaded 7.5dB pad sections. This allows transmit side LBO losses of 0 to 22.5dB in 7.5dB increments. The 3192-9L Issue 4provides

a transmit side LBO which consists of three cascaded pad sections of 4.5, 7.5, and 15dB. This allows transmit side LBO losses of 0, 4.5, 7.5, 15, and 22.5dB. The 3192-9M provides a fixed 4.5dB transmit pad.

3.3 T1 Digital Span Line Powering Design Considerations

The 3192-9L plug-in module has an option which controls the maximum voltage delivered to the span, which determines the maximum span length. When the option is set for −130 volts, the maximum DC simplex span resistance is 2100 ohms. When the module is optioned for ±130V (260V total), the maximum DC simplex resistance is 4300 ohms. The 3192-9M has no power option and provides for a maximum of −130 volts only (2100 ohms).

It is recommended that the −130V power be utilized whenever possible, eliminating possible electrolysis effects of positive voltages that may occur when ±130V is employed. −130V power will provide power for up to approximately nine repeater sections or some 54Kft of cable which should cover the majority of distribution loop applications. T1 span design over the 2100 ohm limit should first consider use of backpowering span power (−130V from both ends, looped at midpoint), as opposed to the ±130 volt option.

The number of line repeaters that can be powered from an STS Repeater is a function of the span's total DC simplex resistance (Rt). This resistance consists of the cable pair simplex resistance (Rc) plus the effective resistance of the line repeaters (Rr) plus the resistance of any looping point along the line (Rl). The calculation for determining total simplex resistance is as follows:

$$(Rt) = (Rc) + (Rr) + (Rl)$$

The above calculations must include the resistance of any looping device at the end of the span. If the T1 span is serving a loop carrier system, this looping device would be the DLC's Line Interface Unit (LIU). If the span is providing customer "T1" service, the simplex resistance of the DS1 Interface Connector (NIU), and/or customer's CSU would need to be included as well. Certain applications can use the 3192-9T Terminating Office Repeater here, as well. Refer to Table 2 for total simplex resistance of various cables, line repeaters and other devices.

Note that the DS1 Interface Connector may loop or thru power the span simplex, depending on option; therefore, it may appear as (Rt) (thru) or (Rl) (loop). If the TELCO span also powers the customer's CSU, FCC Part 68 rules allow the total effective simplex resistance of the CSU plus any associated inside wiring to be up to 1120 ohms, which must be used in calculating total simplex resistance in these applications. Refer to Figure 2 for a typical route example.

3.4 T1 Digital Line Design, Non-Repeated Spans

In metro areas, T1 services are often provisioned via lightwave multiplexer systems placed at or near the customer premises. STS equipment co-located with these multiplexers will facilitate distribution of T1 services throughout large multi-tenant buildings or campus environments. these metallic extensions to customer locations generally have the following characteristics:

- No span (line) repeaters
- 22, 24 or 26 gauge cable
- DS1 Interface Connector; Network Interface Unit (NIU), at the customer location
- May or may not power the customer's CSU

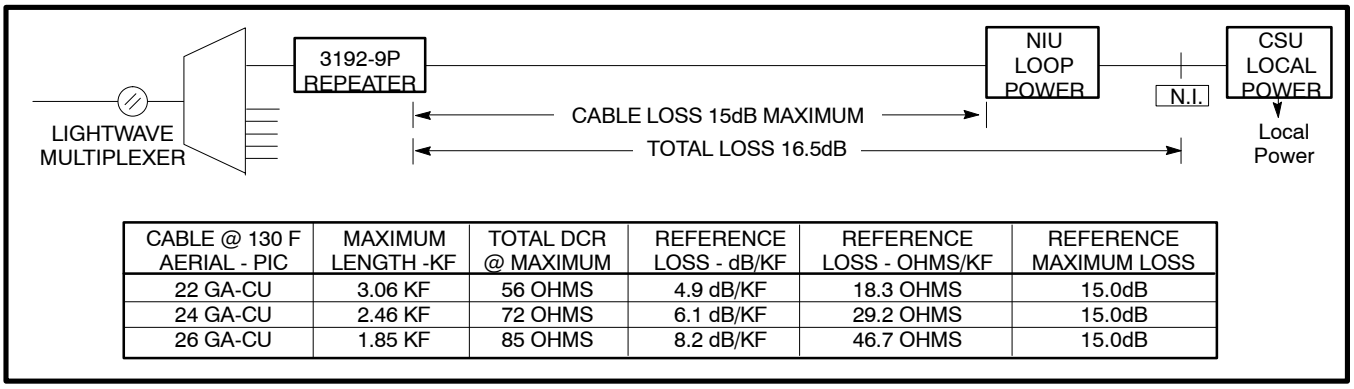
In applications where the span must power the customer's CSU, the 3192-9L or 3192-9M repeaters should be used. These units provide sufficient output voltage at 60 milliamps to power both a DS1 Interface Connector and a CSU.

In those applications where the span provides power only to the DS1 Interface Connector (i.e. the CSU is locally powered), the STS 3192-9P short loop repeater can be used and is optimized for this application. See Figure 1 for a typical application.

The 3192-9P provides DC simplex power to the metallic facility via a 60 milliamp constant current source. This source's maximum output voltage is limited to approximately −36 volts, which is sufficient to power a DS1 Interface Connector over the maximum cable length as shown in Figure 1.

Table 2. Simplex Resistances of Various Cables and Devices

Type of Cable or Device		Simplex Resistance
Cable @ 90 F Buried	19 gauge - Cu 20 gauge - Cu 22 gauge - Cu 24 gauge - Cu 25 gauge - Cu 26 gauge - Cu	8.45 ohms/kft 11.0 ohms/kft 16.8 ohms/kft 26.8 ohms/kft 35.3 ohms/kft 42.6 ohms/kft
Cable @130 F Aerial	19 gauge - Cu 20 gauge - Cu 22 gauge - Cu 24 gauge - Cu 25 gauge - Cu 26 gauge - Cu	9.2 ohms/kft 12.0 ohms/kft 18.3 ohms/kft 29.2 ohms/kft 38.2 ohms/kft 46.7 ohms/kft
T1 Digital Line Repeaters	238 A/C (Thru) 238 A/C (LP To OFC) 238 A/C (LP To Field) 239 A/C (Thru) 239 A/C (LP To OFC) 239 A/C (LP To Field) 239 E/F (Thru) 239 E/F (LP To OFC) 239 E/F (LP To Field) 270 F (Thru) 270 F (LP To OFC) 270 F (LP To Field)	116 ohms 114 ohms 2 ohms 128 ohms 120 ohms 8 ohms 150 ohms 132 ohms 18 ohms 183 ohms 150 ohms 6 ohms
DLC Terminating LIUs and Office Repeaters	AT&T SLC-96 Series 5 LIU-2 Charles Industries 3192-9T (Loop) Charles Industries 3192-9T (Local)	164 ohms 230 ohms 30 ohms
DS1 Maintenance Connectors (NIU)	3551-00 3551-00 List A 3551-00 List U	Loop or thru power 250 ohms max Local power 20 ohms (typical)
CSUs	Channel Service Units, FCC P.68 Limit for CSU plus associated inside wiring	1120



CABLE @ 130 F AERIAL - PIC	MAXIMUM LENGTH -KF	TOTAL DCR @ MAXIMUM	REFERENCE LOSS - dB/KF	REFERENCE LOSS - OHMS/KF	REFERENCE MAXIMUM LOSS
22 GA-CU	3.06 KF	56 OHMS	4.9 dB/KF	18.3 OHMS	15.0dB
24 GA-CU	2.46 KF	72 OHMS	6.1 dB/KF	29.2 OHMS	15.0dB
26 GA-CU	1.85 KF	85 OHMS	8.2 dB/KF	46.7 OHMS	15.0dB

Note: Range is limited to maximum cable loss of 15.0dB.

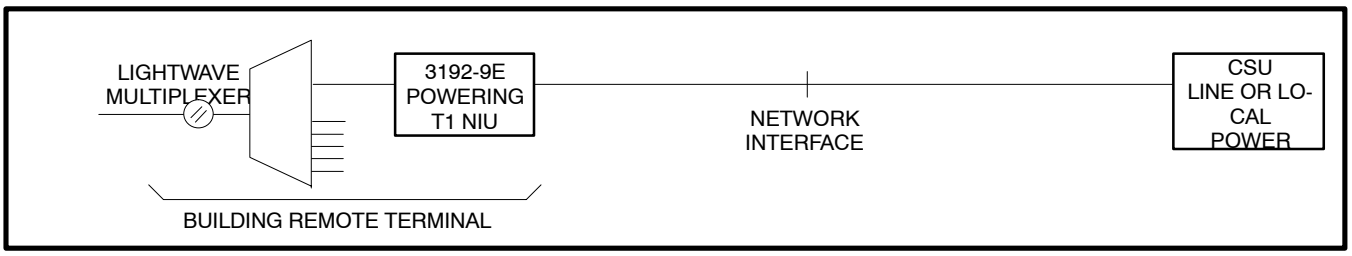
Figure 1. Typical Nonrepeatered Span

Table 3. STS Plug-in Selection Guide

Model #	Issue	CLEI™ Code	Description	Span Voltage	RCV Pad	XMT Pad	DSX Pre Eqlr	DSX Jacks	LOS Alarm	Perf Mon	Notes
3192-9B	2	T1SMCEK4AA	Bridging Office Repeater	NA	7.5 dB	NA	0–655 ft	YES	NO	NO	2
3192-9E	2	T1STETT1AA	T1 Powering NIU	–96	0, note 1	0, 7.5, 15 dB	0–110 ft	YES	YES	NO	2, 3, 5, 7
3192-9L	3	T1R1PAV1AA	Powering Office Repeater	–130, +/–130	0, 7.5 dB	0, 7.5, 15, 22.5 dB	0–655 ft	YES	YES	YES	2, 3
3192-9L	4	T1R1RC01AA		–130, +/–130	0, note 1	0, 4.5, 7.5, 15, 22.5 dB	0–655 ft	YES	YES	YES	2, 3, 4, 5
3192-9M	1	T1R3AB01AA	Powering Office Repeater	–130	0, note 1	4.5 dB	0–110 ft	NO	NO	NO	2, 3, 4, 5
3192-9P	1	T1R1DZ01AA	Short Loop Office Repeater	–36	0, note 1	0, note 6	0–110 ft	YES	NO	NO	2, 3, 5
3192-9T	2	T1R1DOW1AA	Terminating Office Repeater	NA	0, 7.5 dB	0, 7.5, 15, 22.5 dB	0–655 ft	YES	YES	YES	2
3192-9C	1	T1SMEF04AA	Cut-Thru Module	NA	0	0	NA	YES	NO	NO	
APS101	3	NA	Automatic Span Protection Switch	NA	NA	NA	NA	NO	NO	NO	9
3192–TP	1	T1TSN0GEAA	Test Plug	NA	NA	NA	NO	YES	NO	NO	
3192-9F	1	T1AVWD17AA	Alarm Summary Module	Notes: 1. Wide range regenerator circuit accommodates 0 to –35 dB without pad. 2. Improved performance with 3:24 stress code. 3. Improved power cross immunity. 4. B8ZS compatible performance monitor. 5. High efficiency span power regulator. 6. No XMT pad; XMT path insertion. Loss =1.5 dB. 7. Integral NIU with loopback. 8. Addressable loopback. 9. Provides 2 to 1 span line protection.							
3192-FL	1	T1FLB606AA	Fault Locate Module								
3192-OW	1	T1PQ9BH1AA	Order Wire Module								

In some building remote terminal applications, the customer network interface may be co-located with the STS equipment. This equipment configuration is typical in minimum point of presence (MPOP) service arrangements. To eliminate the need for a separate network interface unit (NIU), the STS plug-in family includes the 3192-9E Powering T1 NIU unit. The 3192-9E combines the functions of a Powering T1 Office Repeater plus a T1 Network Interface Unit conforming to Bellcore TR-TSY-000312 in a single high density plug-in module.

The 3192-9E provides NIU maintenance loopback functions in either SF or ESF control code formats. The 3192-9E can be optioned to provide a constant 60mA source, at up to 96 volts, to power the customer's CSU if required. A typical 3192-9E application is shown in Figure 2. Additional information on the 3192-9E is provided in Section 319-29E-20X.



Note: Power consumption and heat release data for the 3192-9E NIU is provided in Section 319-29E-20X

Figure 2. Typical 3192-9E Powering T1 NIU Application

3.5 System Power Engineering

The input current consumption and heat release of the STS System will vary considerably with span simplex resistance and type of T1 circuit pack equipment.

All STS Mounting Shelves provide a split power bus having two battery inputs, A and B. In 3192-11 Issue 3 23" mounting assemblies, Bus A feeds circuit positions 1 through 14, and Bus B feeds positions 15 through 28. In 3192-11 Issue 4 23" mounting assemblies, Bus A feeds positions 1, 2, 5, 6, 9, 10, 13, 14, 17, 18, 21, 22, 25 and 26; Bus B feeds positions 3, 4, 7, 8, 11, 12, 15, 16, 19, 20, 23, 24, 27, and 28. In 19" mounting assemblies, Bus A feeds positions 1 through 11, and Bus B feeds positions 12 through 22. Position 29 in 23" shelves and position 23 in 19" shelves is always associated with the 3192-9F Alarm Summary Module. This position is fed by both buses A and B. STS shelf power wiring is shown in Figure 11 through Figure 13.

Table 4 provides input current and heat release data for individual plug-ins. Table 5 and Table 6 provide input current, recommended power bus fusing, and heat release for fully equipped 23" and 19" shelf assemblies respectively.

Table 4 through Table 6 provide data for various possible STS application scenarios. This allows the system engineer to readily determine the system's power engineering parameters in typical deployment applications.

Table 4. Plug-In Current Consumption and Heat Release Data

	Application	Loop Simplex Resistance	Plug-in Type				
			3192-9L Iss. 3	3192-9L Iss. 4	3192-9M Iss. 1	3192-9P Iss. 1	APS101 Iss. 1
Maximum Plug-in Unit Input Current @ -48V	Repeaterless	500 ohms	0.12 amps	0.075 amps	0.071 amps	0.063 amps	0.065 amps
	CSA	800 ohms	0.15 amps	0.10 amps	0.10 amps		
	130V Limit	2100 ohms	0.25 amps	0.22 amps	0.223 amps		
	260V Limit	4300 ohms	0.46 amps	0.43 amps			
Maximum Plug-in Unit Input Current @ -42.5V	Repeaterless	500 ohms	0.13 amps	0.087 amps	0.082 amps	0.063 amps	0.071 amps
	CSA	800 ohms	0.16 amps	0.12 amps	0.11 amps		
	130V Limit	2100 ohms	0.27 amps	0.25 amps	0.25 amps		
	260V Limit	4300 ohms	0.49 amps	0.49 amps			
Maximum Plug-in Heat Release	Repeaterless	500 ohms	3.9 watts	1.7 watts	1.5 watts	1.6 watts	1.6 watts
	CSA	800 ohms	4.0 watts	1.9 watts	1.7 watts		
	130V Limit	2100 ohms	4.3 watts	2.5 watts	2.3 watts		
	260V Limit	4300 ohms	5.8 watts	3.7 watts			

Table 5. 23" Mounting Shelf Current Consumption and Heat Release Data

	Application	Loop Simplex Resistance	Equipped with 28 each of					
			3192-9L Iss. 3	3192-9L Iss. 4	3192-9M Iss. 1	3192-9P Iss. 1	3192-9E Iss. 1	APS101 Iss. 1
Total Shelf Input Current @ -48V	Repeaterless	500 ohms	3.4 amps	2.1 amps	2.0 amps	1.8 amps		1.8 amps
	CSA	800 ohms	4.2 amps	2.8 amps	2.8 amps			
	130V Limit	2100 ohms	7.0 amps	6.2 amps	6.2 amps			
	260V Limit	4300 ohms	12.9 amps	12.0 amps				
	Powering co-located 68 volt CSU						5.6 amps	

	Application	Loop Simplex Resistance	Equipped with 28 each of					
			3192-9L Iss. 3	3192-9L Iss. 4	3192-9M Iss. 1	3192-9P Iss. 1	3192-9E Iss. 1	APS101 Iss. 1
Total Shelf Input Current @ -42.5V	Repeaterless	500 ohms	3.6 amps	2.4 amps	2.3 amps	1.8 amps		1.8 amps
	CSA	800 ohms	4.5 amps	3.4 amps	3.1 amps			
	130V Limit	2100 ohms	7.6 amps	7.0 amps	7.0 amps			
	260V Limit	4300 ohms	13.7 amps	13.7 amps				
	Powering co-located 68 volt CSU						6.2 amps	
Recommended -48V Bus Fusing — Per Bus	Repeaterless	500 ohms	3.0 amps	2.0 amps	2.0 amps	2.0 amps		2.0 amps
	CSA	800 ohms	3.0 amps	2.0 amps	2.0 amps			
	130V Limit	2100 ohms	5.0 amps	5.0 amps	5.0 amps			
	260V Limit	4300 ohms	10.0 amps	10.0 amps				
	Powering co-located 68 volt CSU						5.0 amps	
Total Shelf Heat Release	Repeaterless	500 ohms	109 watts	48 watts	42 watts	45 watts		45 watts
	CSA	800 ohms	112 watts	53 watts	48 watts			
	130V Limit	2100 ohms	120 watts	70 watts	65 watts			
	260V Limit	4300 ohms	162 watts	104 watts				
	Powering co-located 68 volt CSU						100 watts	

Table 6. 19” Mounting Shelf Current Consumption and Heat Release Data

	Application	Loop Simplex Resistance	Equipped with 22 each of					
			3192-9L Iss. 3	3192-9L Iss. 4	3192-9M Iss. 1	3192-9P Iss. 1	3192-9E Iss. 1	APS101 Iss. 1
Total Shelf Input Current @ -48V	Repeaterless	500 ohms	2.6 amps	1.7 amps	1.6 amps	1.4 amps		1.4 amps
	CSA	800 ohms	3.3 amps	2.2 amps	2.2 amps			
	130V Limit	2100 ohms	5.5 amps	4.8 amps	4.8 amps			
	260V Limit	4300 ohms	10.1 amps	9.4 amps				
	Powering co-located 68 volt CSU						4.4 amps	
Total Shelf Input Current @ -42.5V	Repeaterless	500 ohms	2.9 amps	1.9 amps	1.8 amps	1.4 amps		1.4 amps
	CSA	800 ohms	3.5 amps	2.6 amps	2.4 amps			
	130V Limit	2100 ohms	5.9 amps	5.5 amps	5.5 amps			
	260V Limit	4300 ohms	10.8 amps	10.8 amps				
	Powering co-located 68 volt CSU						4.9 amps	
Recommended -48V Bus Fusing — Per Bus	Repeaterless	500 ohms	3.0 amps	2.0 amps	2.0 amps	1.0 amps		1.6 amps
	CSA	800 ohms	3.0 amps	2.0 amps	2.0 amps			
	130V Limit	2100 ohms	5.0 amps	5.0 amps	5.0 amps			
	260V Limit	4300 ohms	10.0 amps	10.0 amps				
	Powering co-located 68 volt CSU						4 amps	

	Application	Loop Simplex Resistance	Equipped with 22 each of					
			3192-9L Iss. 3	3192-9L Iss. 4	3192-9M Iss. 1	3192-9P Iss. 1	3192-9E Iss. 1	APS101 Iss. 1
Total Shelf Heat Release	Repeaterless	500 ohms	86 watts	37 watts	33 watts	35 watts		35 watts
	CSA	800 ohms	88 watts	42 watts	37 watts			
	130V Limit	2100 ohms	95 watts	55 watts	51 watts			
	260V Limit	4300 ohms	128 watts	81 watts				
	Powering co-located 68 volt CSU						79 watts	

4. MOUNTING

STS Shelves and wired assemblies are available to mount in 19” and 23” rack assemblies. Table 7 shows the STS shelf assemblies and their features. The shelf mounting holes accommodate either 1.75” or 2” rack drilling.

Table 7. STS Shelf Assembly Selection Guide

Model #	Issue	CLEI Code	Description	Width (inches)	Circuit Capacity	Signal Lead Connections	Notes
3192-11	5	T1M4PT0FRA	23-inch Connectorized Mounting Shelf	23	28	32 pair male connectors	1, 2, 3
3192-SA	1	T1MRFM05RA	23-inch STS Mounting Shelf	23	28	See section 319-2SA-00X	
3192-SB	1	T1MRFAE5RA	23-inch STS Mounting Shelf	23	28	See section 319-2SB-00X	
3192-WR	1	T1MRGW05MA	23-inch Wirewrap Mounting Shelf	23	28	Wirewrap	1, 2, 3
319-02	2	Pending	19-inch Connectorized Mounting Shelf	19	22	25 pair male connectors	1, 2, 3
319-02	3	T1M4RZ0FRA	19-inch Connectorized Mounting Shelf	19	22	25 pair male connectors	1, 2, 3
319–04	1	Pending	19–inch Wirewrap Mounting Shelf	19	22	Wirewrap	1, 2, 3

Notes:

1. Adjustable mounting ears.
2. Improved locking bar & rear cover.
3. Static wrist strap jack.

STS shelves require 5.25” of vertical rack space. STS installations that are cabled for front access require approximately 6” of vertical rack space to accommodate the front access cables that are routed over the top of the shelf.

In CEV or Central Office applications, dedicated frames can be allocated to STS shelves. Up to eight STS shelves can be accommodated in a 7’ frame. In this application, two 1.75” mounting spaces should be provided between each STS shelf for proper convection cooling. Example 1 of Figure 3 shows such an arrangement.

In cabinet assemblies, STS shelves are usually miscellaneously mounted with other equipment such as lightwave multiplexers, DSX jackfields, etc. Since vertical rack space is usually very limited in these assemblies, it is desirable to mount equipment assemblies as close as possible, while maintaining adequate airflow for equipment cooling. The following guidelines have been established to assist the system engineer in achieving acceptable system thermal performance.

- Limit the number of STS shelves in any one cabinet vertical mounting space to three shelves
- Mount the STS equipment as low as possible in the cabinet assembly
- Provide minimum one 1.75” mounting space below the STS equipment for proper convection cooling
- Provide one 1.75” mounting space between each STS shelf for proper convection cooling
- Provide minimum one 1.75” mounting space above the STS equipment for proper convection cooling

Observance of the above guidelines should result in adequate thermal performance in most situations. These guidelines, however, are not a substitute for proper thermal analysis of any particular cabinet application. It is the responsibility of the cabinet system engineer to perform such analysis, insuring the STS equipment will remain within its specified ambient temperature range.

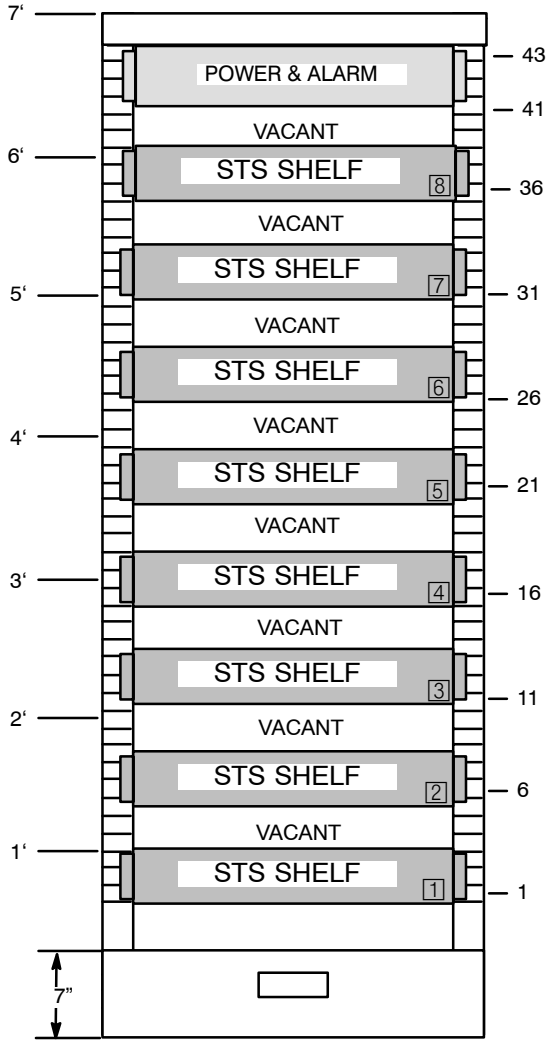
In CEV applications, “reversed” unequal flange duct bays are often used. All STS shelves with their standard 5” front projection can be used in these front load applications. See Figure 4.

In some applications, it may be desired to rear load STS shelves in unequal flange duct bays, as shown in Figure 5. For this application, it is necessary to reverse the mounting ears and change their location as shown. In addition, it is also necessary to remove the static wrist strap jack mounted on the right hand side of the shelf.

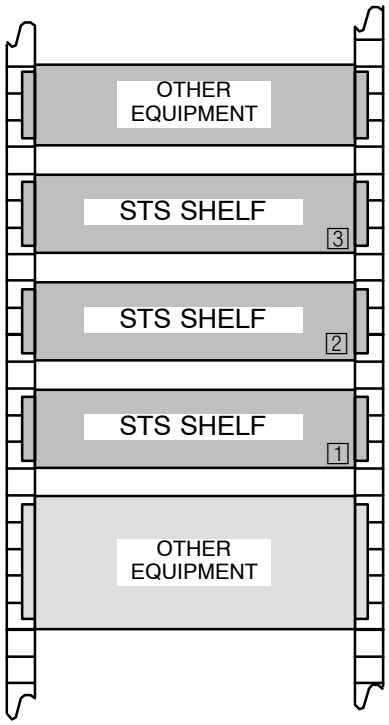
Note: Power consumption and heat release data for the 3192-9E NIU is provided in Section 319-29E-20X.

Additionally, in certain situations, such as indoor cabinets, it may be possible to achieve greater equipment stacking density, than that prescribed by the above guidelines, while maintaining adequate equipment temperatures.

All STS equipment shelves and wired assemblies contain adjustable mounting ears. These shelves are shipped from the factory with their adjustable ears in the standard 5” front projection position. By moving the mounting ears to the optional positions, front projections of 6” and 7” can be provided as shown in Figure 4.



Example 1. CO or CEV Rack



Example 2. Cabinet or Miscellaneous Mount

Figure 3. Equipment Vertical Spacing Guidelines

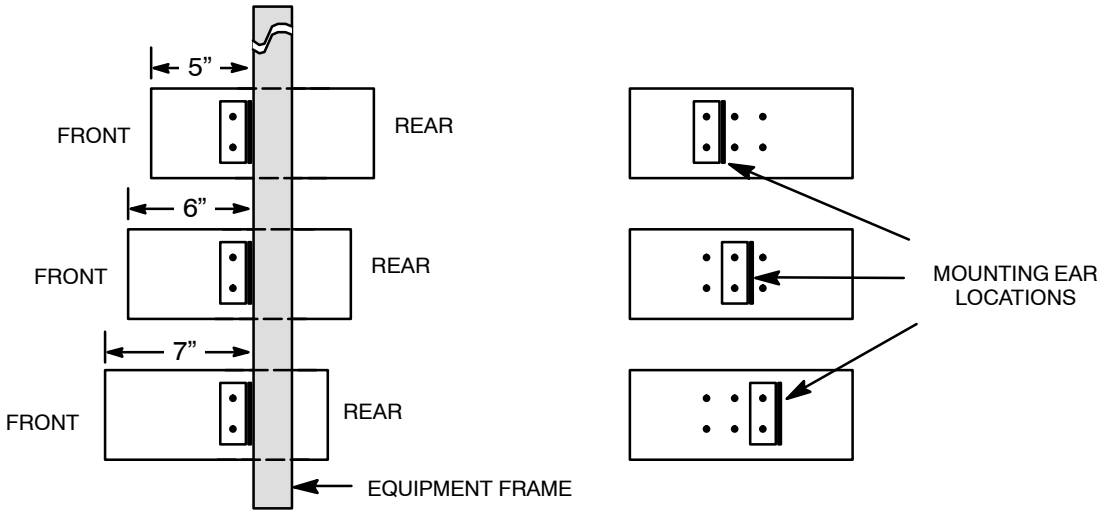


Figure 4. Equipment Horizontal Mounting—Channel Rack Applications

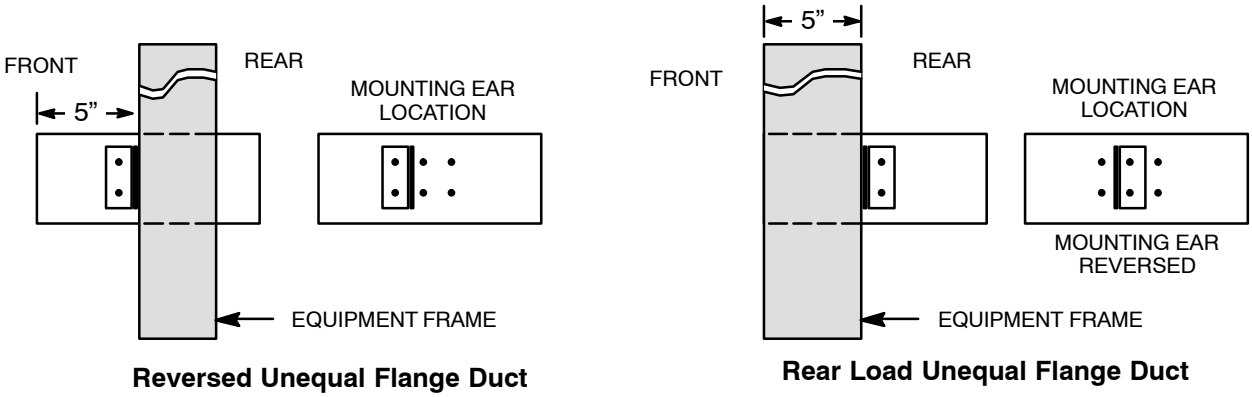


Figure 5. Equipment Horizontal Mounting—Unequal Flange Duct

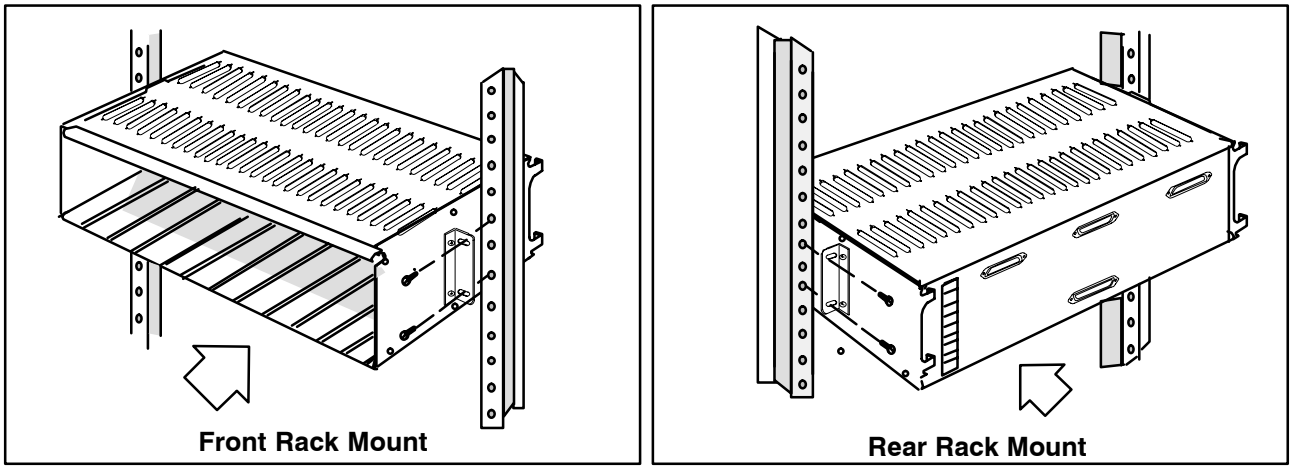


Figure 6. Equipment Horizontal Mounting — Rack Mounting

5. INSTALLER CONNECTIONS

5.1 Signal Leads

STS shelves are typically installed between a T1 span facility and a DSX-1 cross connect. The DSX-1 cross connect can be a DSX-1 jack field, a wire wrap cross connect, or direct cabling between the STS system and a lightwave multiplexer or other equipment. Figure 7 and Figure 8 show the typical cabling in these applications.

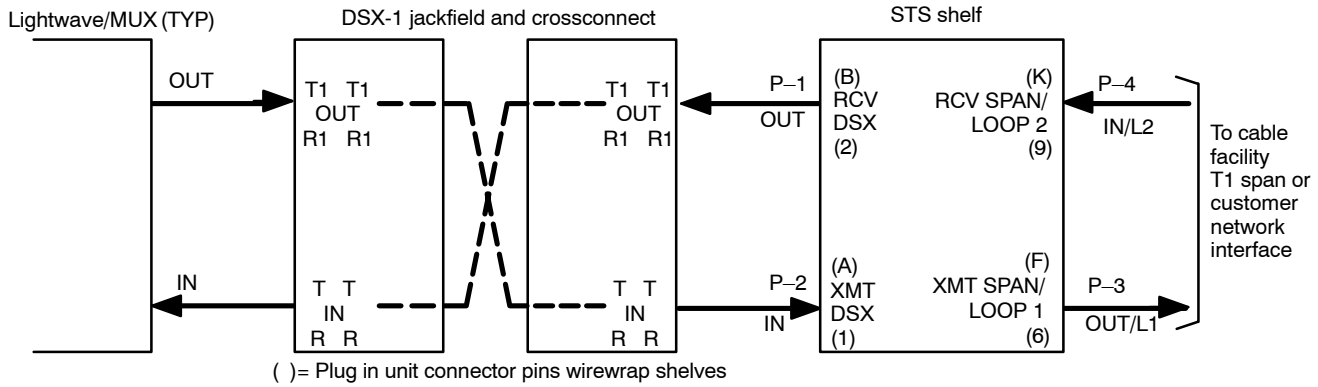


Figure 7. STS Cabling Convention With DSX Jackfield

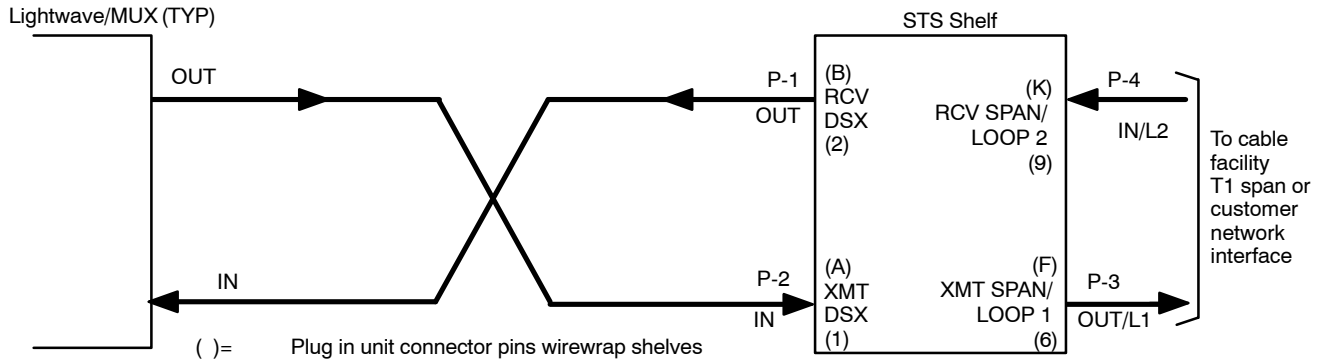


Figure 8. STS Cabling Convention Without DSX Jackfield

5.2 Connectorized Shelf Assemblies, 3192-11 & 319-02

When using the STS connectorized 3192-11 or 319-02 shelf assembly, the signal lead connections are made to the four backplane connectors, P1 through P4. Figure 9 and Figure 10 show the signal lead wiring of the 3192-11 and 319-02 shelves respectively. Figure 11 through Figure 13 show the common internal wiring of these shelves. The locations of connectors P1 through P4 are shown in Figure 14 and Figure 15 for each shelf assembly.

Hand-tighten connector screws! Overtightening the screws can damage the connectors or the shelf. Screws for connectors attached at P1–P4 should be no tighter than a torque value of 6 inch/pounds.

5.2.1. 3192-11 Shelf Assembly

On the 3192-11 23" connectorized shelf assembly, P1 through P4 are 32-pair male connectors that are internally wired in sequential order starting with shelf position 1 on pair 1, position 2 on pair 2, etc. Each connector carries 28 pairs of like signals i.e., P1 = RCV to DSX (out), P2 = XMT from DSX (in), P3 = XMT to span (out), and P4 = RCV from span (in). When the shelf is equipped with HDSL HTU-C modules, P3 = Loop 1 and P4 = Loop 2.

5.2.2. 319-02 Shelf Assembly

On the 319-02 19" connectorized shelf assembly, P1 through P4 are 25-pair male connectors that are wired in sequential order starting with shelf position 1 on pair 1, position 2 on pair 2, etc. Each connector carries 22 pairs of like signals i.e., P1 = RCV to DSX (out), P2 = XMT from DSX (in), P3 = XMT to span (out), and P4 = RCV from span (in). When the shelf is equipped with HDSL HTU-C modules, P3 = Loop 1 and P4 = Loop 2.

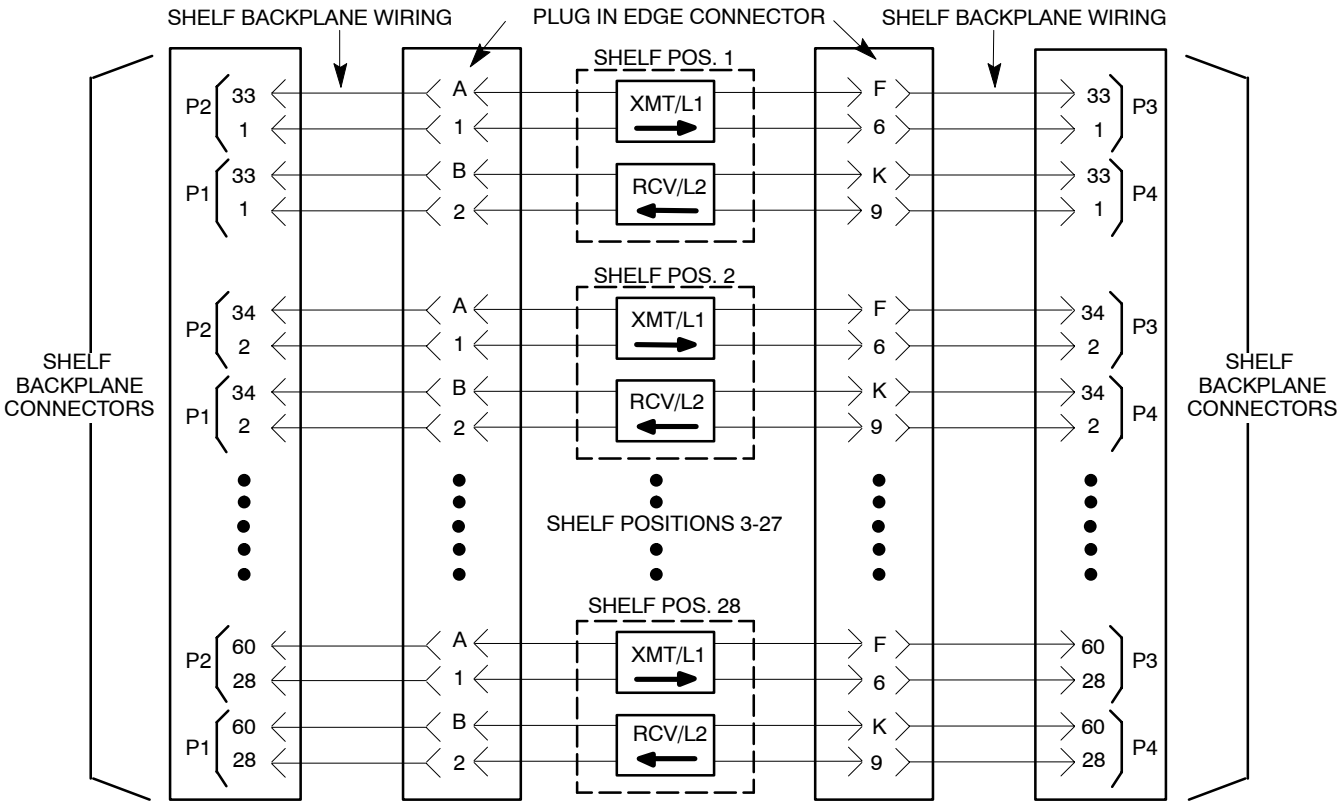


Figure 9. 3192-11 23" Connectorized Mounting Shelf Internal Signal Lead Wiring Diagram

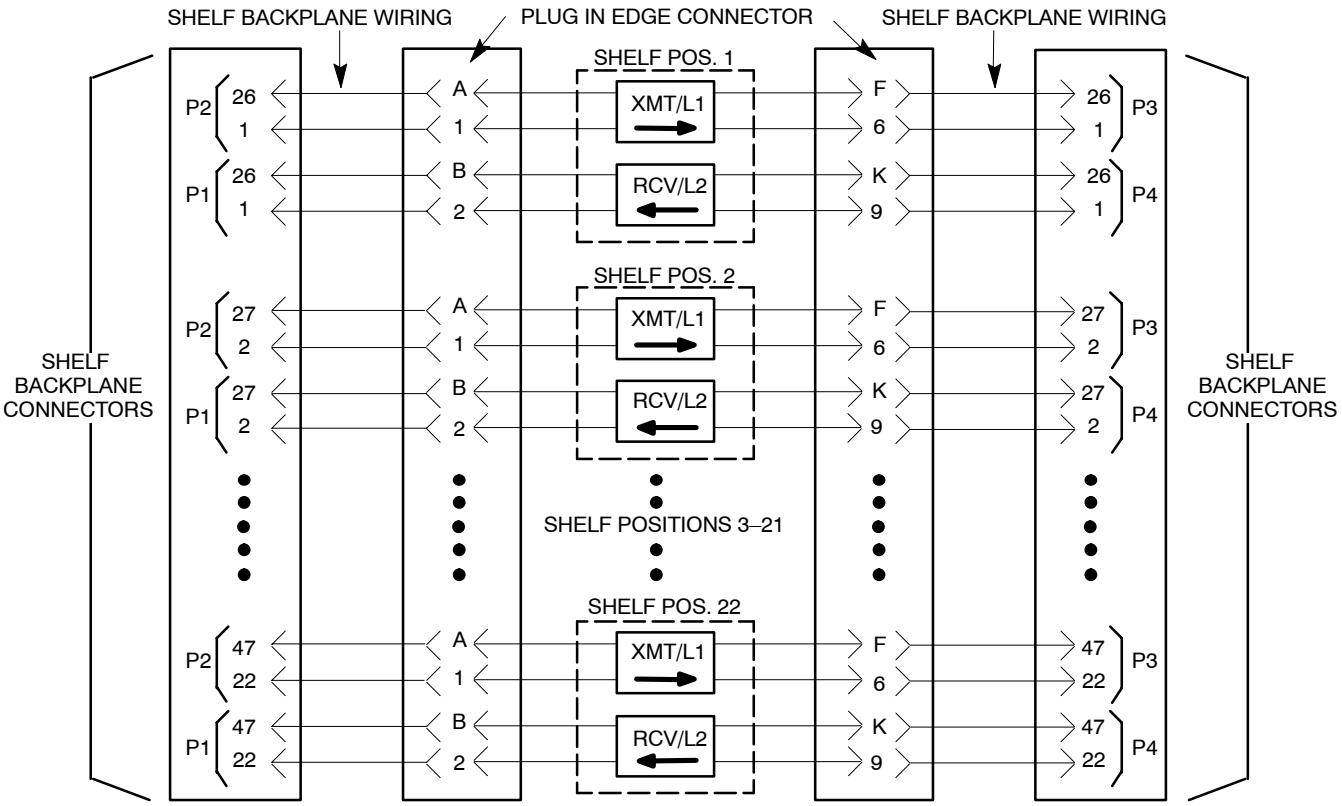


Figure 10. 319-02 19" Connectorized Mounting Shelf Internal Signal Lead Wiring Diagram

CAUTION

Use 24 gauge (maximum) solid tinned copper wire with a foil shield.

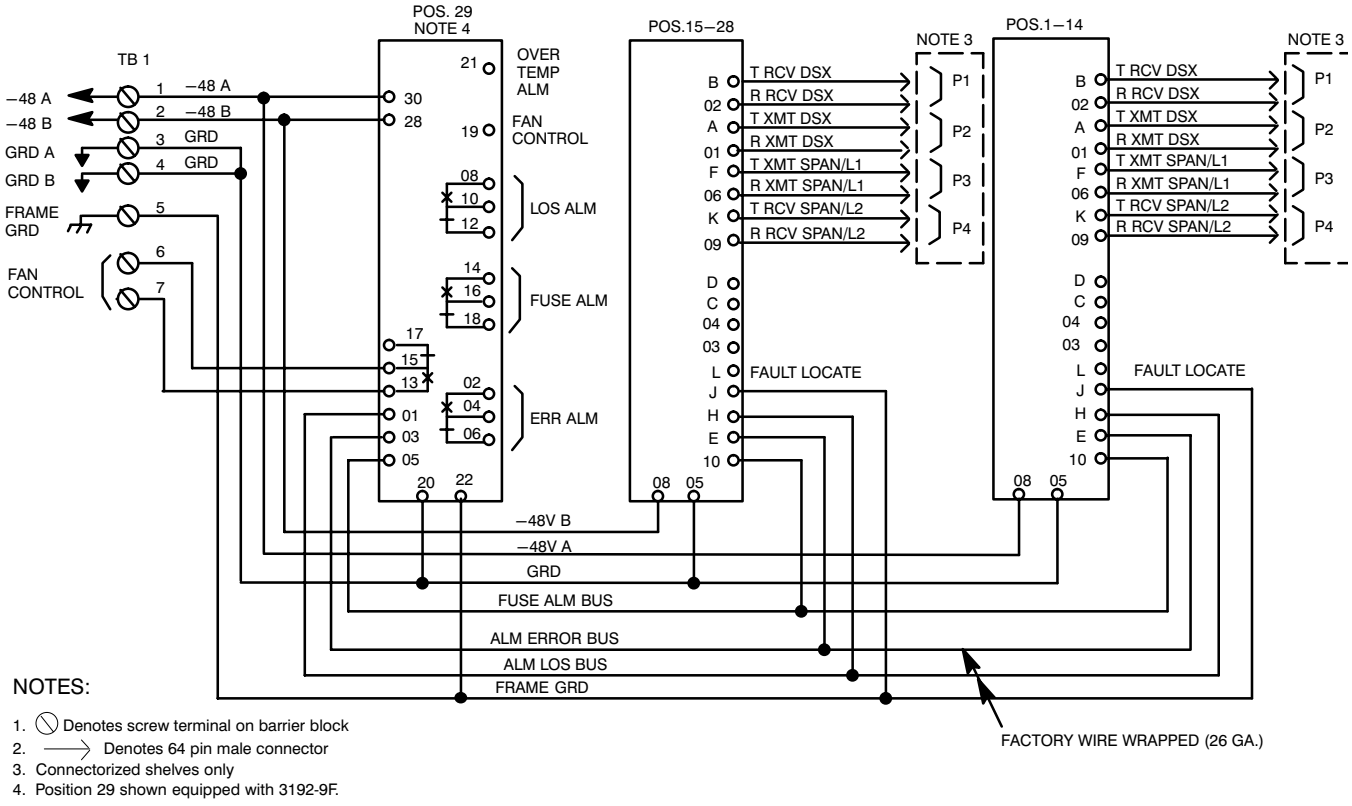


Figure 11. 3192-11 23" STS Shelf Assembly Internal Wiring Diagram

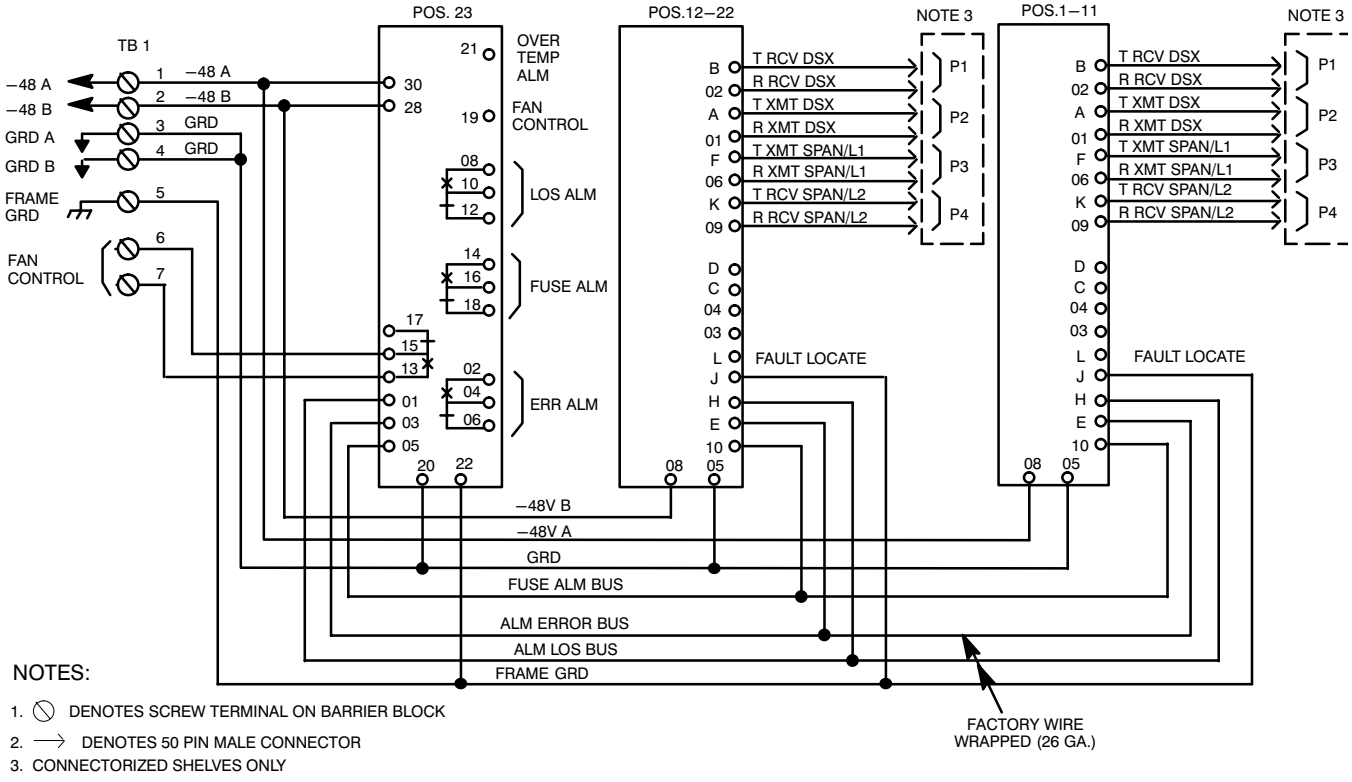


Figure 12. 319-02 Issue 1 and 2 19" STS Shelf Assembly Wiring Diagram

CAUTION

Use 24 gauge (maximum) solid tinned copper wire with a foil shield.

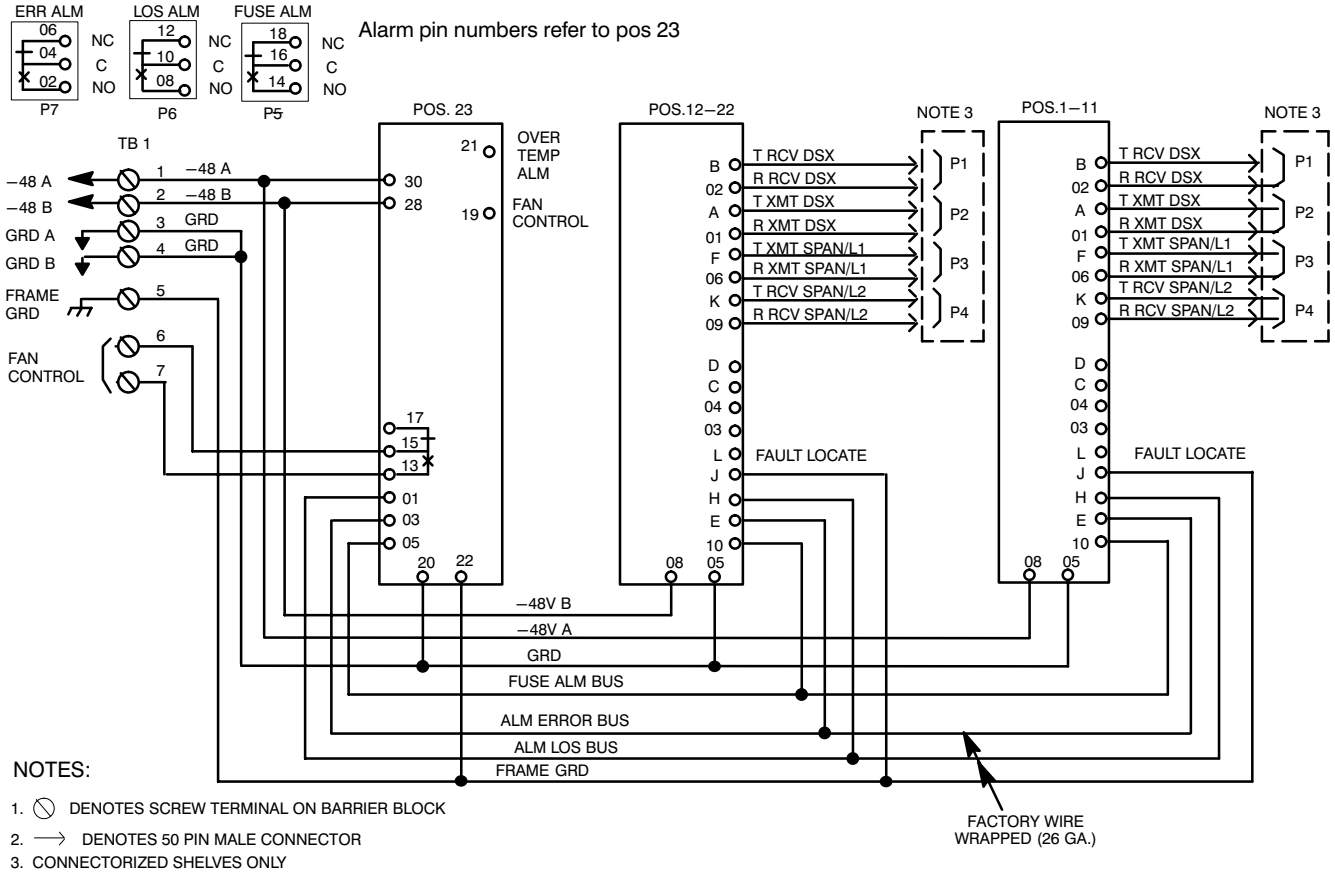


Figure 13. 319–02 Issue 3 19" STS Shelf Assembly Wiring Diagram

CAUTION

Use 24 gauge (maximum) solid tinned copper wire with a foil shield. Alarm pins located above TB1 can take up to 22 guage (maximum).

5.3 Factory Terminated Cable Assemblies for 3192-11 & 319-02 Connectorized Shelf Assemblies

To facilitate installations that use the 3192-11 or 319-02 connectorized shelf assemblies, a family of factory terminated cable assemblies are available as optional equipment. These cables have one end terminated in a female connector that mates with connectors P1 through P4 of the shelf backplane while the other end is terminated as indicated below. Each cable contains 24 gauge solid tinned copper wire with a foil shield. This foil shield is connected to a drain wire at the shelf end for attachment to the shelf at the location shown in Figure 14 and Figure 15.

5.3.1. Cable Assembly for the 3192-11 Shelf

The cable assembly for the 3192-11 23" connectorized shelf assembly, has one end terminated in a 32-pair female connector while the other end is either blunt cut or terminated in either 710-type or MS2 splicing connectors.

5.3.2. Cable Assembly for the 319-02 Shelf

The cable assembly for the 319-02 19" connectorized shelf assembly, has one end terminated in a 25-pair female connector while the other end is blunt cut. Figure 16 through Figure 20 show the physical configuration and ordering information for the factory terminated cable assemblies. Figure 21 through Figure 25 show the wiring of these cable assemblies.

5.4 Wirewrap Shelf Assemblies 3192-WR and 319-04

The STS family provides both 23" (3192-WR) and 19" (319-04) wirewrap shelves. These shelf assemblies provide wirewrap terminals on the backplane for installer signal lead connections. A rear view of these shelves is shown

in Figure 26. Also provided is a wiring duct for cable routing. Figure 27 shows transmission lead wiring for the 3192-WR and 319-04 shelves. The wirewrap pins on the 3192-WR and 319-04 shelves can accept up to 22 gauge wire. Signal leads are wirewrapped to the edge connector pins as shown, and routed through the wiring duct in directions as shown in Figure 27. Power and common wiring is as shown in Figure 11 and Figure 12.

5.4.1. Wirewrap Shelf Connections

Wire wrapping to edge connector pins must be made in accordance with IPC-A-610 Class 2 and GR-78-CORE latest editions in order to assure the correct installation and reliability of the product.

- The maximum wire size on .025 square pins is 24 gauge.
- Never apply torque to the pin while installing a wire wrap.
- Use the correct sized bit (i.e., use a 26 gauge small bit for 26 gauge wire on .025 pins).
- Modified wire wraps are recommended for 26 gauge and smaller wire on .025 square pins. (See GR-78-CORE).
- Strip lengths need to accommodate the number of wire wraps to be installed.
- Excessive wire wraps can cause pin breakage.

CAUTION

Wire wrapping should be performed by personnel trained in accordance with industry requirements for wire wrap installation. Tooling for wire wrap termination and de-termination must be manufactured for this purpose and sized for the specific wire to be installed. Incorrect wire wrapping could result in broken pins.

Special attention should be given to the connectorized shelves which have edge connectors with .025 X .025 pins. System alarm connections are made directly with wire wrap connections and edge connector pins allow for other connections within the connector array.

5.5 Type 3192-SA & 3192-SB Shelf Assemblies

The 3192-SA and 3192-SB Shelf Assemblies are special versions of the 3192-11 shelf and are equipped with a wire wrap adapter on connectors P3 and/or P4. For additional information refer to Sections 319-2SA-00X and 319-2SB-00X.

5.6 Power, Alarm & Miscellaneous Connections

Each STS shelf assembly contains a screw terminal block designated TB1. Shelf –48V power, –48V return, frame ground, and fan control connections are made to TB1. The TB1 terminals are designed to accept up to 14 gauge wire. TB1 connections are shown in Figure 28. Other system alarm connections are made directly to the wirewrap pins of the edge connector in position 29 of the 23” shelf. The wirewrap connections to position 29 are designed to accept up to a 24 gauge wire.

The 19” shelf issues 1 and 2 alarm connections are located on the edge connector of position 23. Refer to Figure 12. In the issue 3 version, the alarm pins have been physically separated from the position 23 edge connector but still maintain continuity to it. Alarm pins can accept up to 22 guage wire while the other signal connections accept up to 24 guage wire. Refer to Figure 13. All of these connections are also shown in Figure 28.

To facilitate power and alarm connections, a family of connectorized cable assemblies are available. Figure 29 shows the power cable assembly. One end is wired to TB1 on the shelf assembly, and the other end terminates in a 4-pin plug. A mating cable assembly is available in various lengths for connection to associated power circuits. Figure 30 shows the cable assemblies for alarm connections, which are provided in a similar manner.

Power cable and alarm cables are connected to TB1 and position 23 or 29 as shown in Figure 31.

Hand-tighten connector screws! Overtightening the screws can damage the connectors or the shelf. Screws for power connections at TB1 should be no tighter than a torque value of 8 in./lbs.

5.7 Plug In Unit Interconnections

The STS system provides a uniform wiring plan to accommodate various types of plug in units. Figure 32 through Figure 40 show functional block diagrams of the various plug in units, their edge connector pin-outs, as well as the P-( ) connections for use in connectorized shelf assemblies.

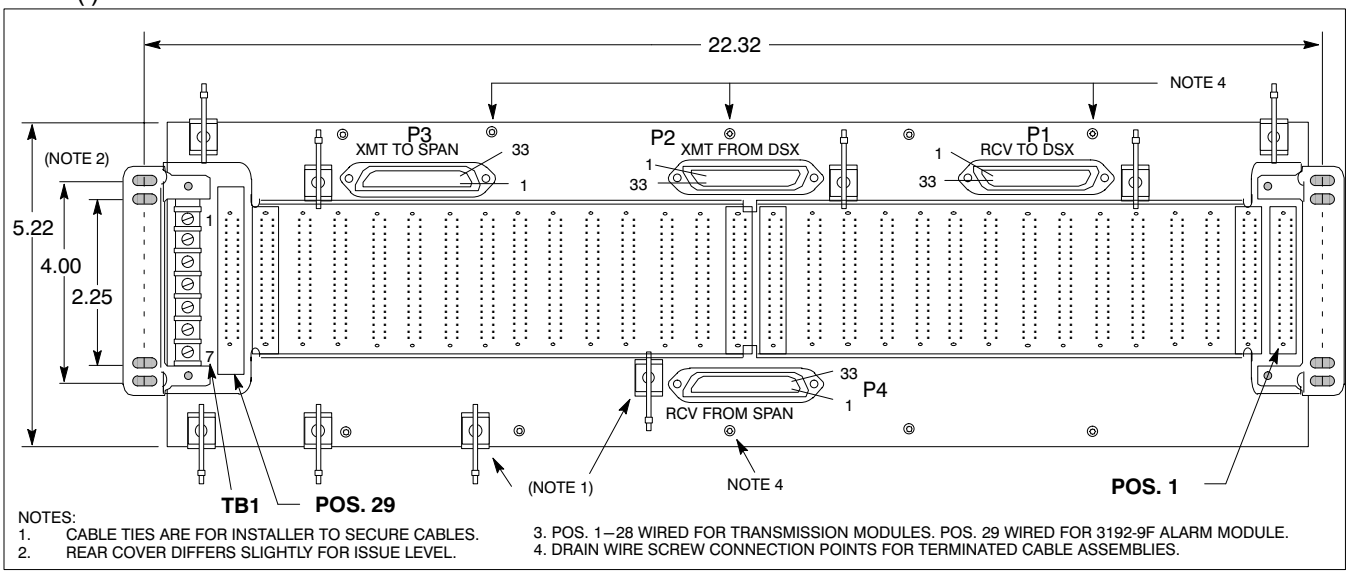


Figure 14. 3192-11 STS Shelf Assembly, 23" Connectorized, Rear View

CAUTION

Hand-tighten connector screws! Overtightening the screws can damage the connectors or the shelf. Screws for connectors attached at P1–P4 should be no tighter than a torque value of 6 in./lbs. Screws for power connections at TB1 should be no tighter than a torque value of 8 in./lbs.

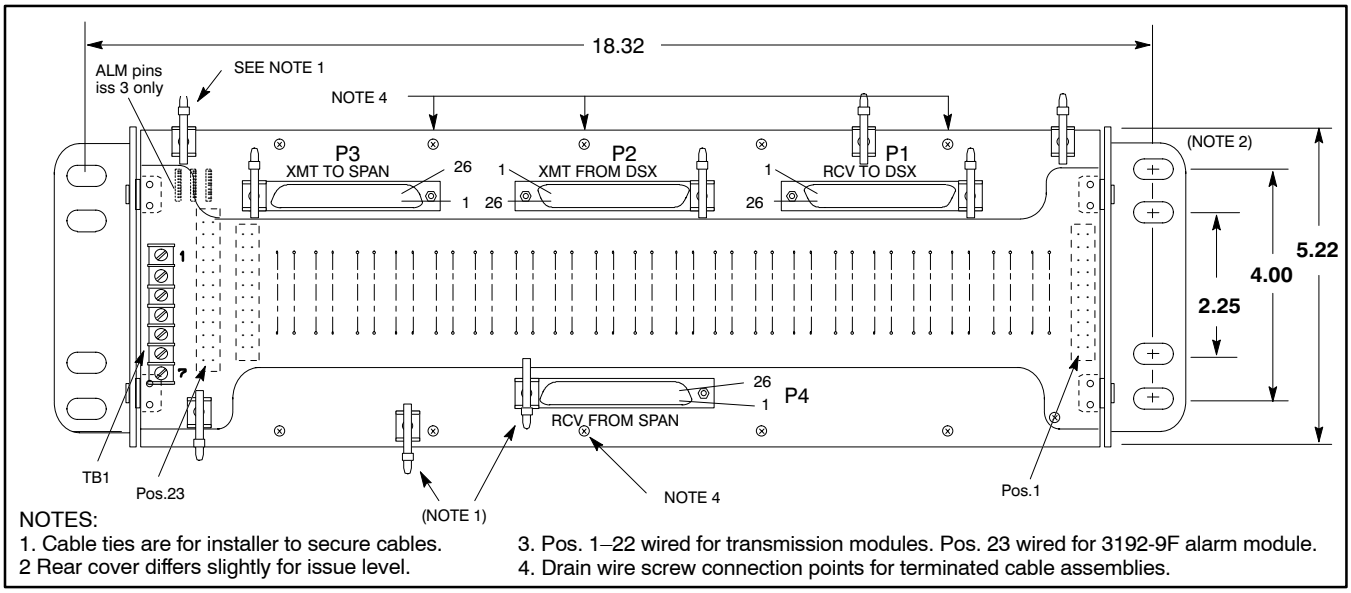


Figure 15. 319-02 STS Shelf Assembly, 19" Connectorized, Rear View

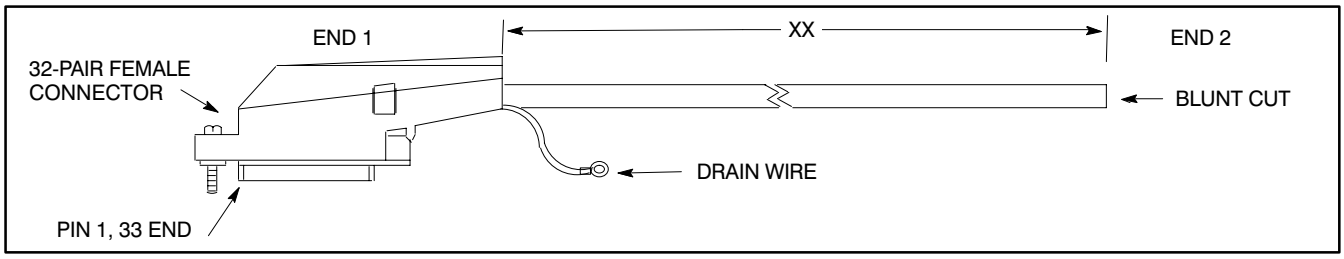


Figure 16. Shelf Connecting Cable Stub Assembly — 003-2972XX

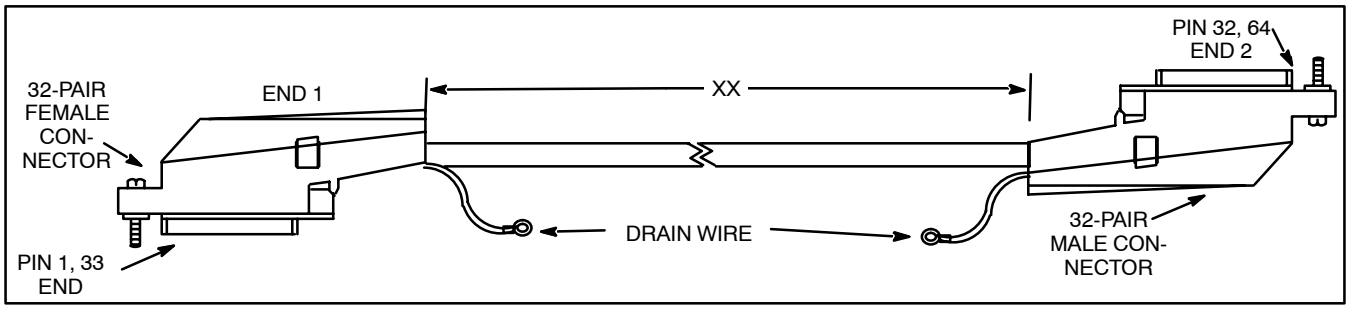


Figure 17. Shelf Connecting Cable Stub Assembly — 03-2973XX-0

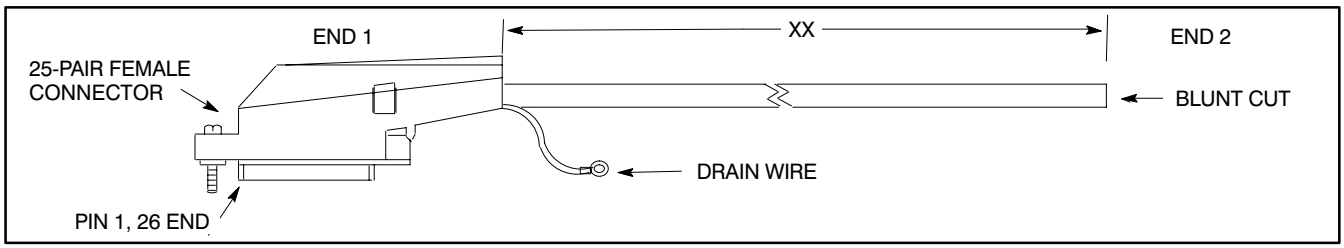


Figure 18. Shelf Connecting Cable Stub Assembly — 003-2975XX

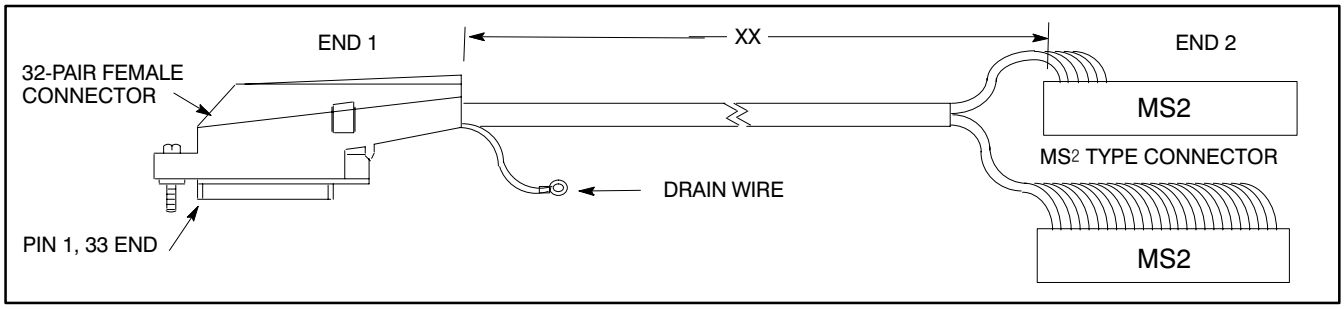


Figure 19. Shelf Connecting Cable Assembly with MS2 Type Connector - 003-2976XX

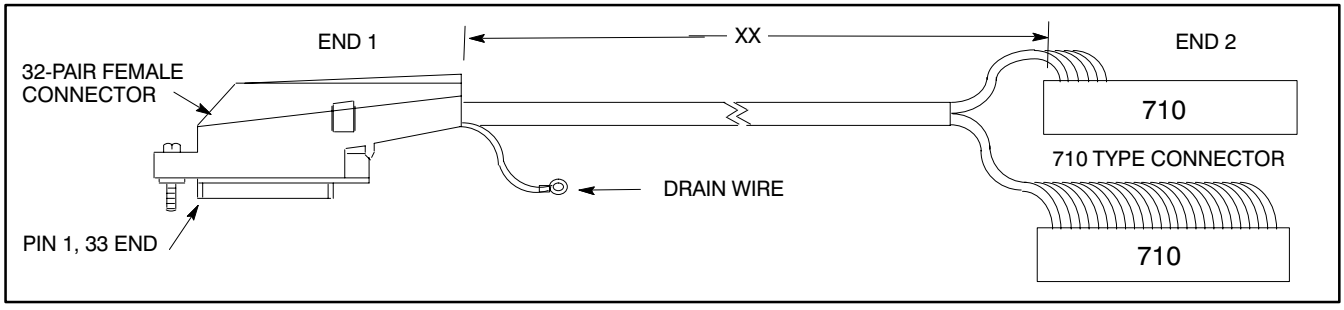


Figure 20. Shelf Connecting Cable Assembly with 710 Type Connector - 003-2977XX

Table 8. STS Cable Assembly Ordering Information

32 Pair Female to Blunt Cut, used with 3192-11	32 Pair Female to Male, used with 3192-11	25 Pair Female to Blunt Cut, used with 319-02	32 Pair Female to MS2, used with 3192-11	32 Pair Female to 710, used with 3192-11	Length XX
03-297201-0	03-297301-0	03-297501-0	03-297601-0	03-297701-0	1 feet
03-297202-0	03-297302-0	03-297502-0	03-297602-0	03-297702-0	2 feet
03-297203-0	03-297303-0	03-297503-0	03-297603-0	03-297703-0	3 feet
03-297204-0	03-297304-0	03-297504-0	03-297604-0	03-297704-0	4 feet
03-297205-0	03-297305-0	03-297505-0	03-297605-0	03-297710-0	5 feet
03-297210-0	03-297310-0	03-297510-0	03-297610-0	03-297710-0	10 feet
03-297215-0	03-297315-0	03-297515-0	03-297615-0	03-297715-0	15 feet
03-297220-0	03-297320-0	03-297520-0	03-297620-0	03-297720-0	20 feet
03-297230-0	03-297330-0	03-297530-0	03-297630-0	03-297730-0	30 feet
03-297240-0	03-297340-0	03-297540-0	03-297640-0	03-297740-0	40 feet
03-297250-0	03-297350-0	03-297550-0	03-297650-0	03-297750-0	50 feet
03-297200-0	03-297300-0	03-297500-0	03-297600-0	03-297700-0	100 feet
03-2972A5-0	03-2973A5-0	03-2975A5-0	----------	----------	150 feet
03-2972A0-0	03-2973A0-0	03-2975A0-0	----------	----------	200 feet
03-2972B5-0	03-2973B5-0	----------	----------	----------	250 feet
03-2972B0-0	03-2973B0-0	----------	----------	----------	300 feet

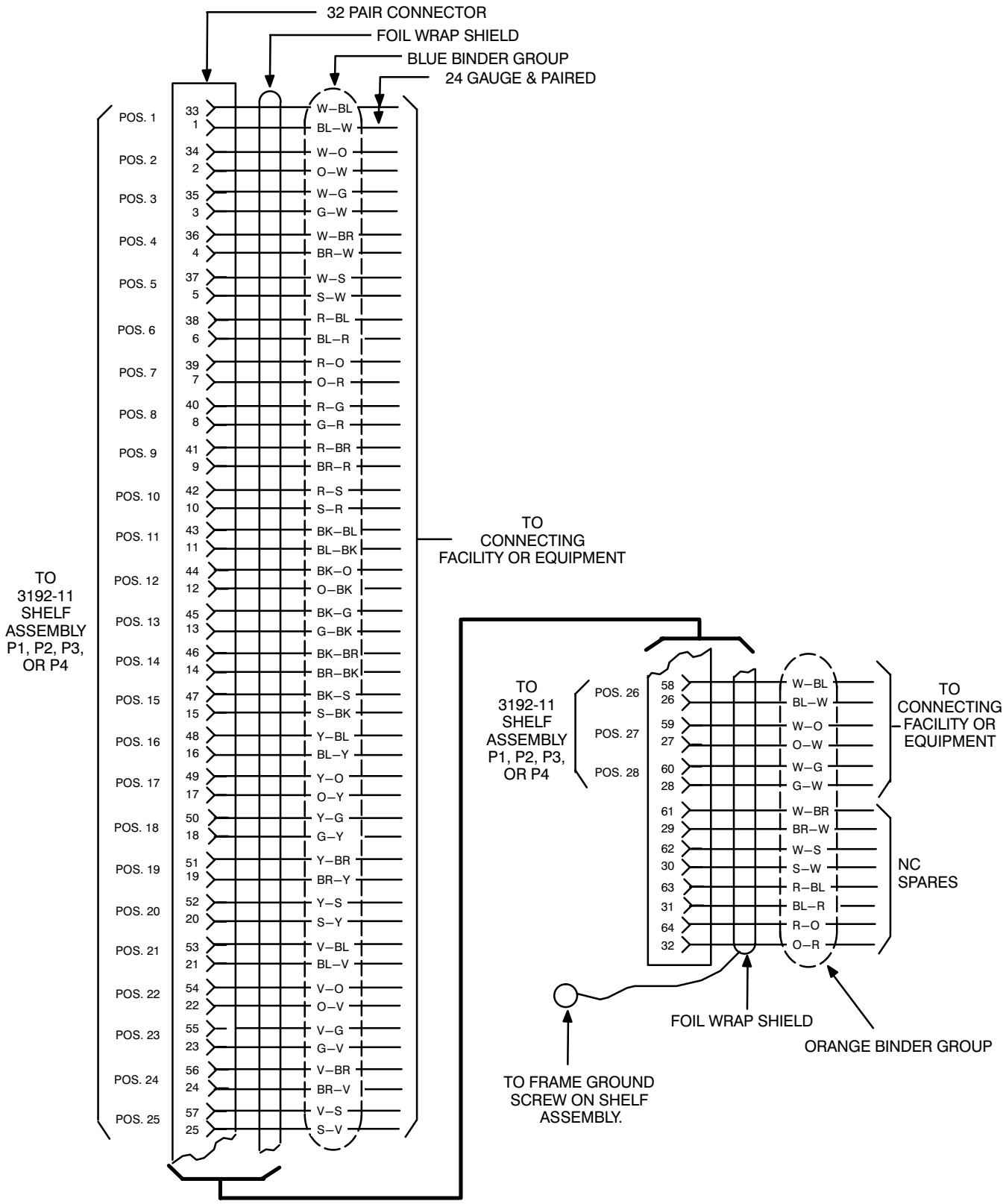


Figure 21. 32 Pair Blunt-Cut Cable Assembly 003-2972XX Wiring Diagram

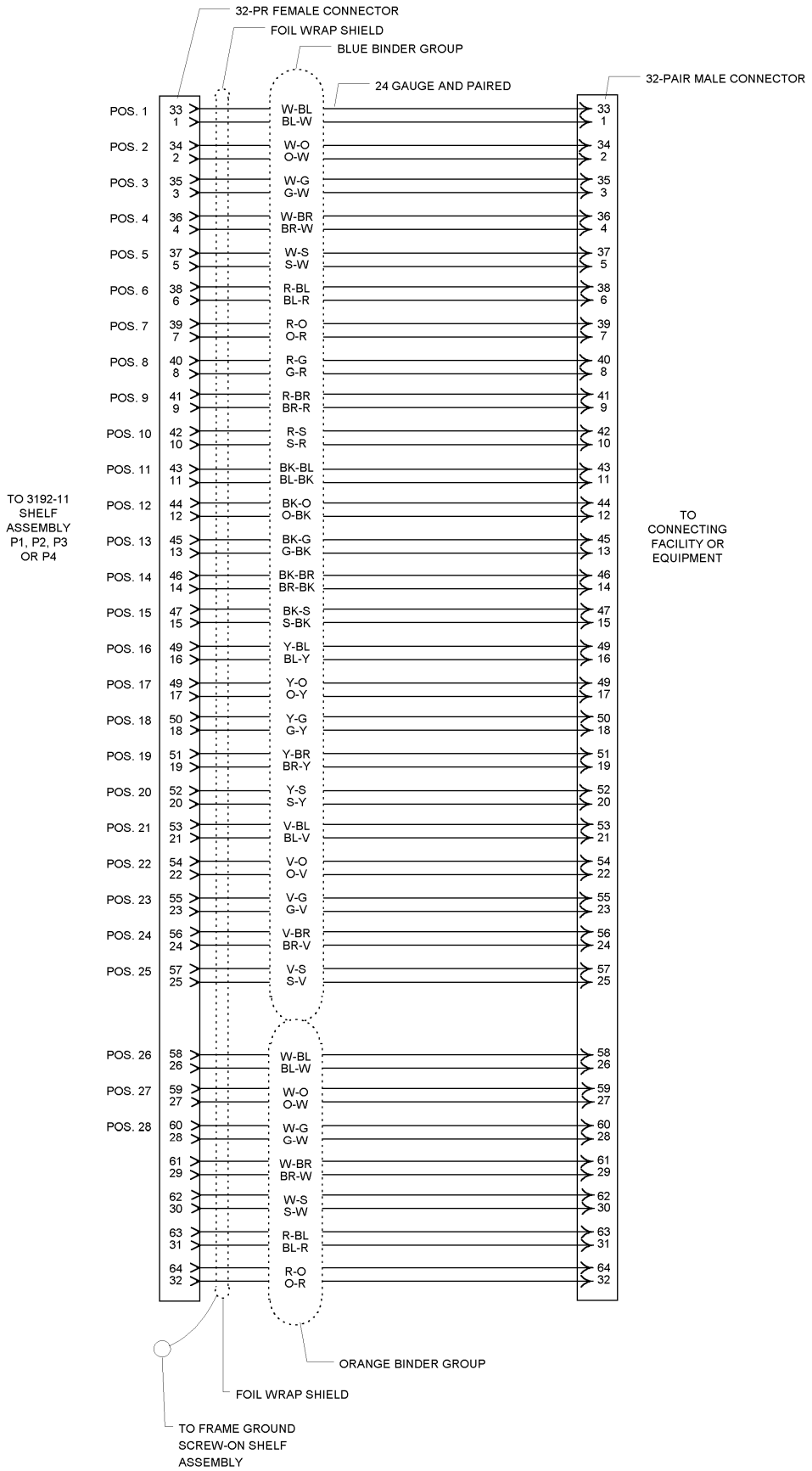


Figure 22. 32 Pair Male-Female Cable Assembly 03-2973XX-0 Wiring Diagram

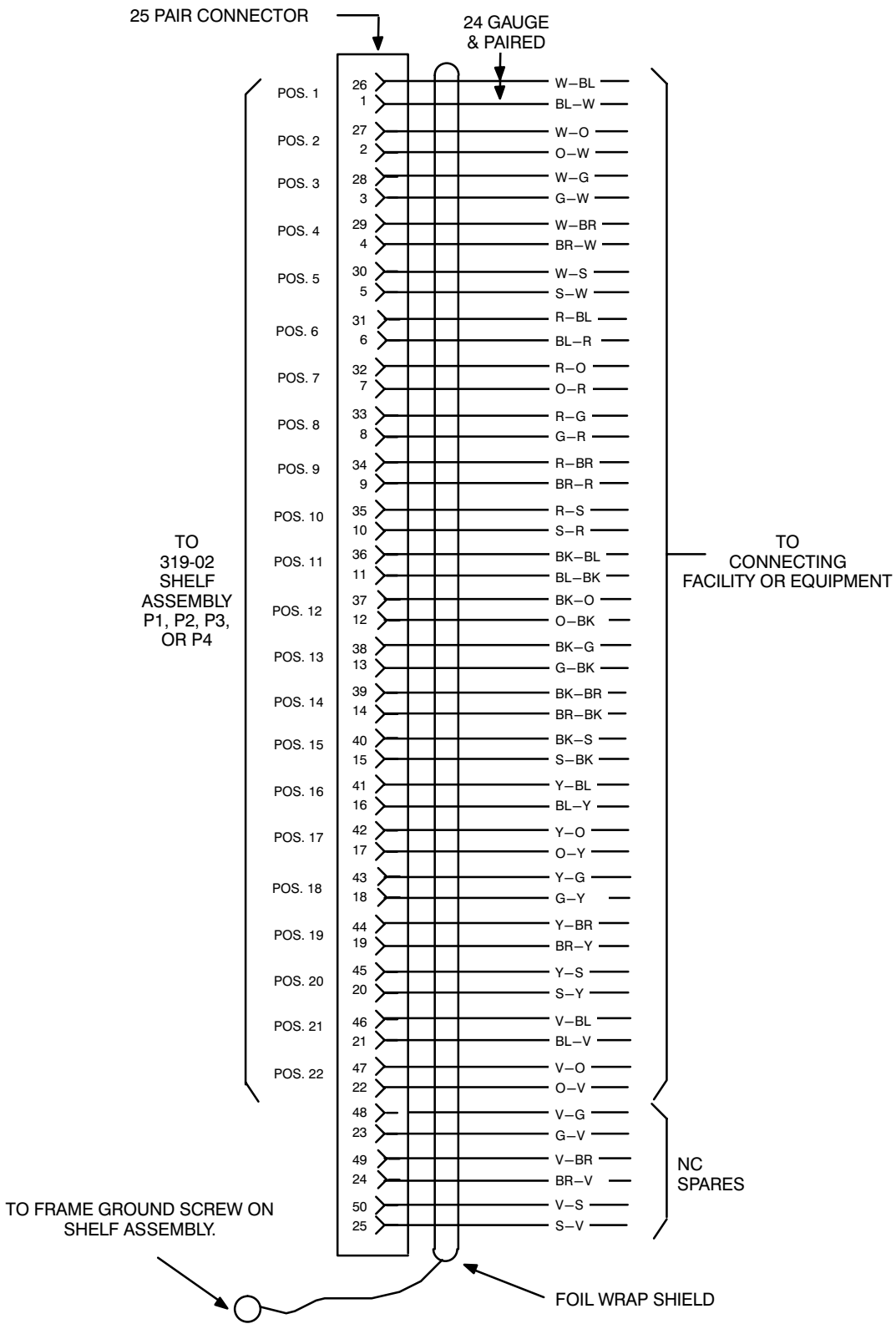


Figure 23. 25 Pair Blunt-Cut Cable Assembly 003-2975XX Wiring Diagram

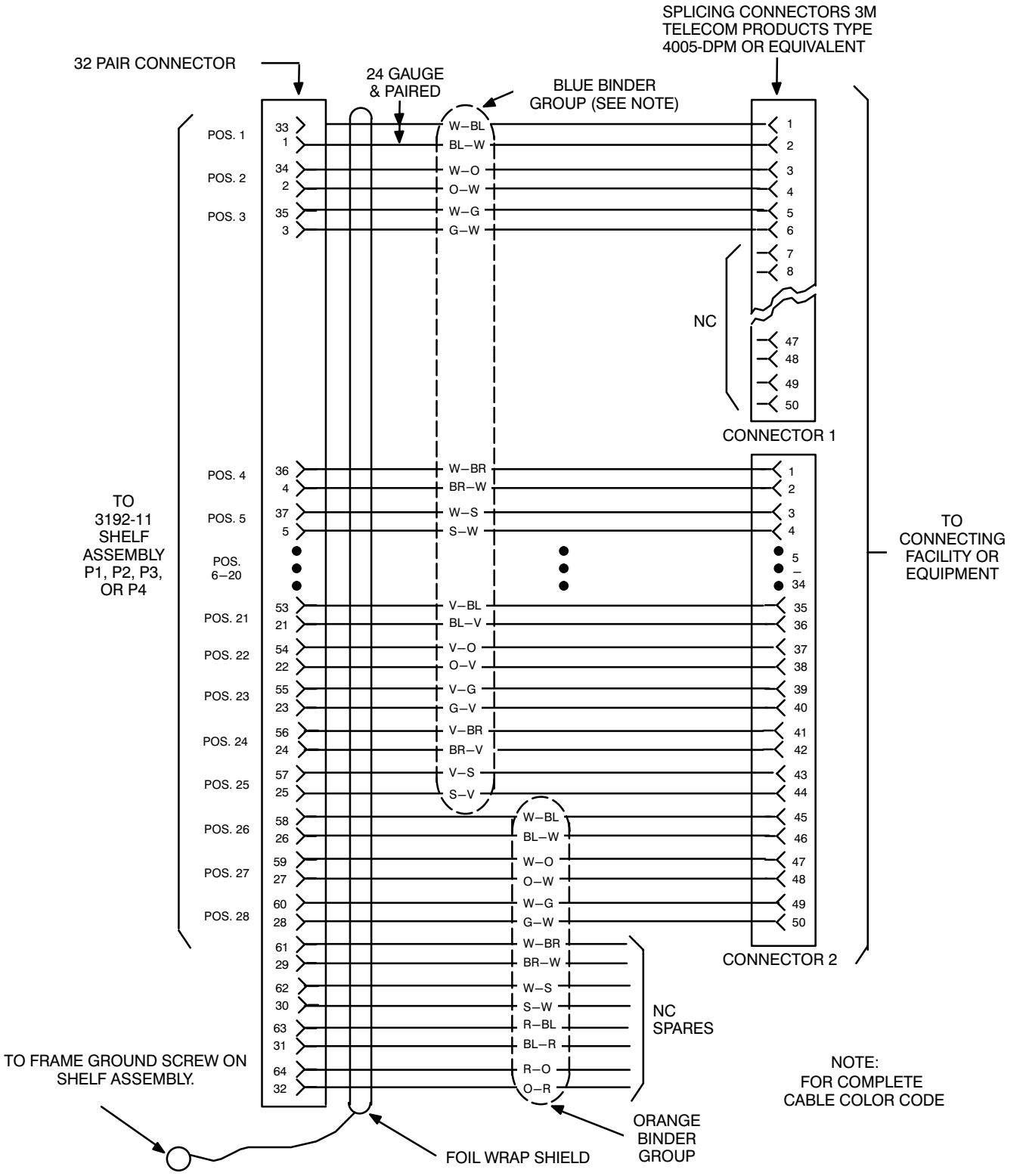


Figure 24. 32 Pair MS2 Connectorized Cable Assembly 003-2976XX Wiring Diagram

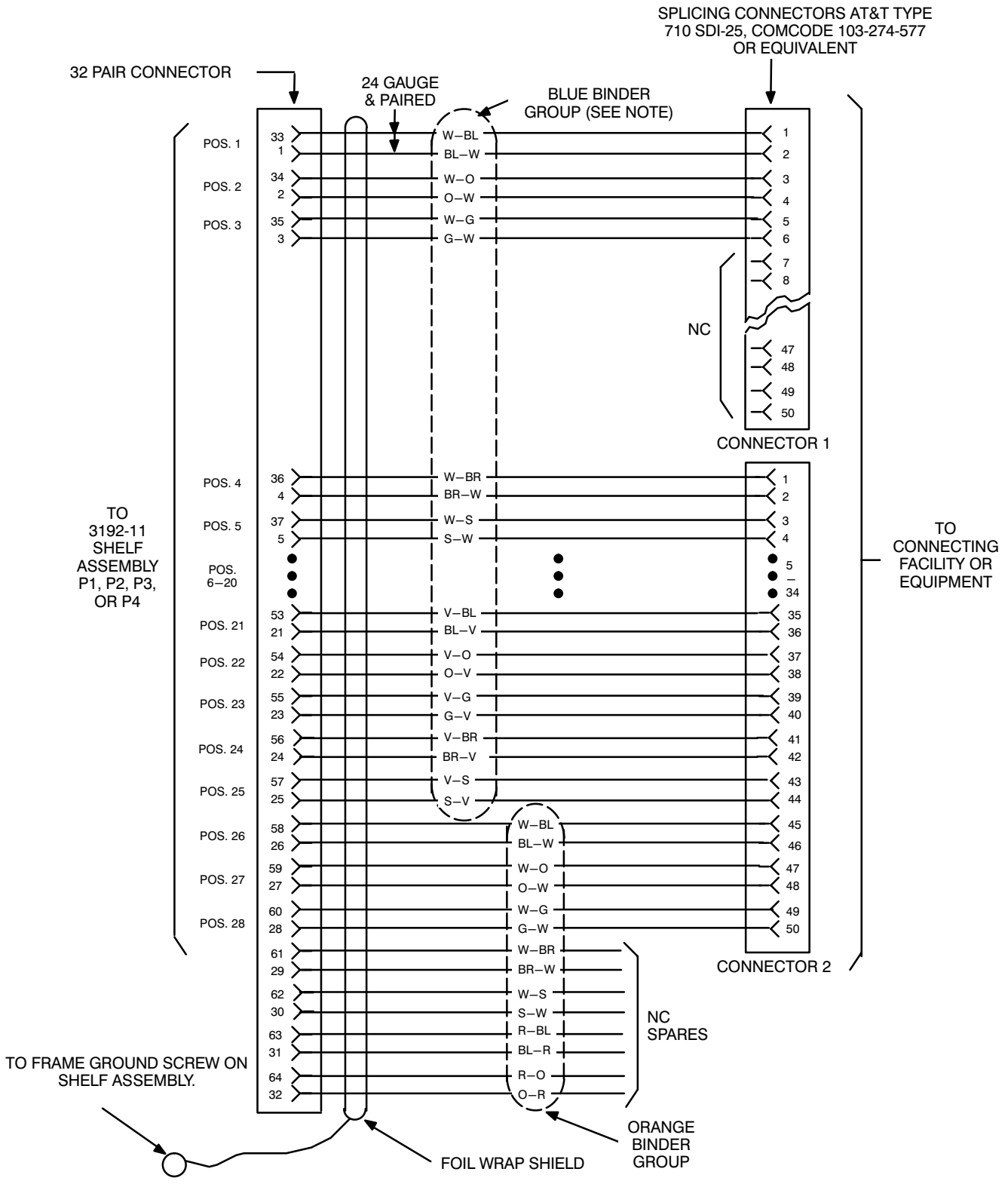


Figure 25. 32 Pair 710 Connectorized Cable Assembly 003-2977XX Wiring Diagram

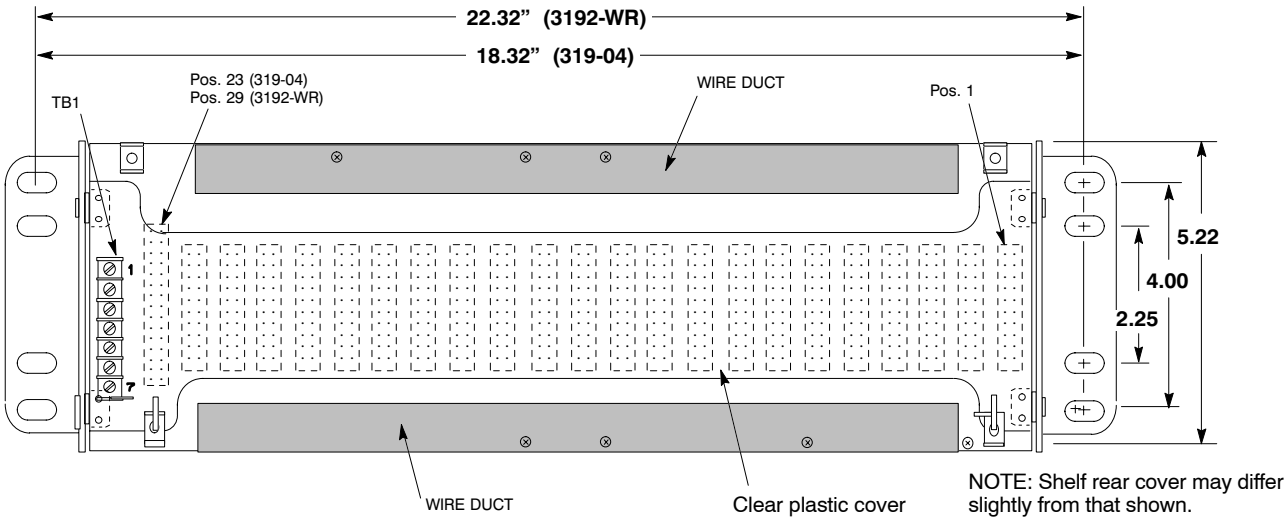


Figure 26. 319-04 19-Inch Wirewrap Mounting Shelf and 3192-WR 23-Inch Wirewrap Mounting Shelf, Rear View

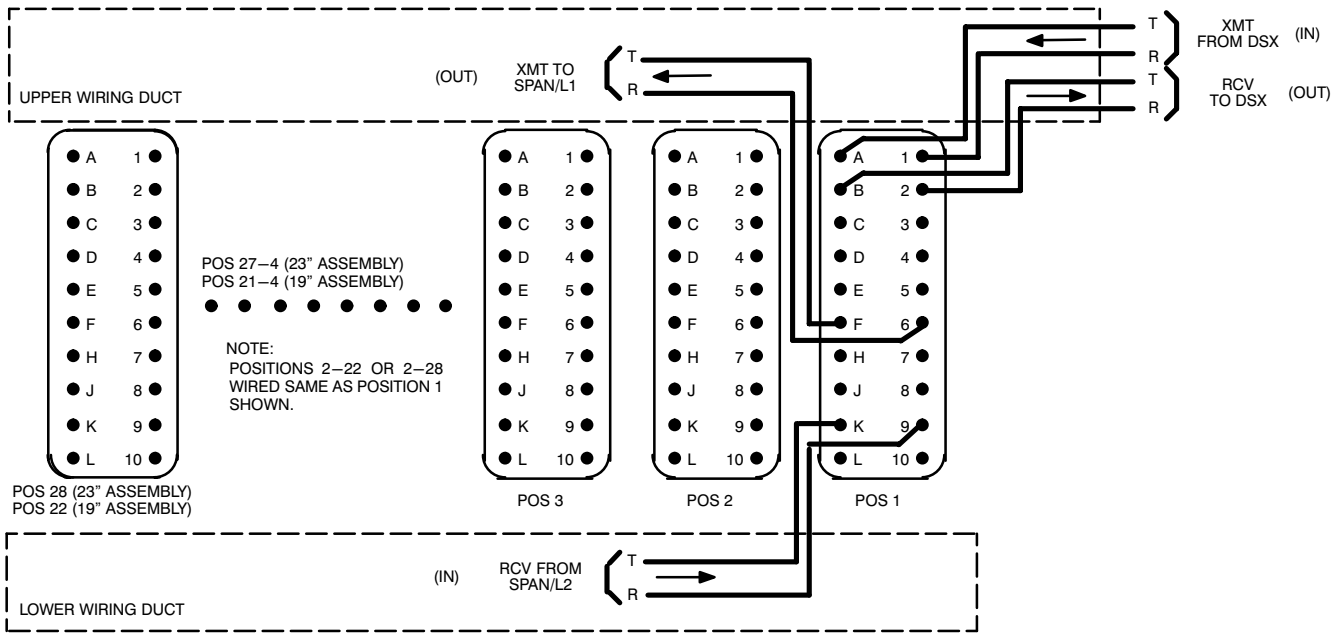
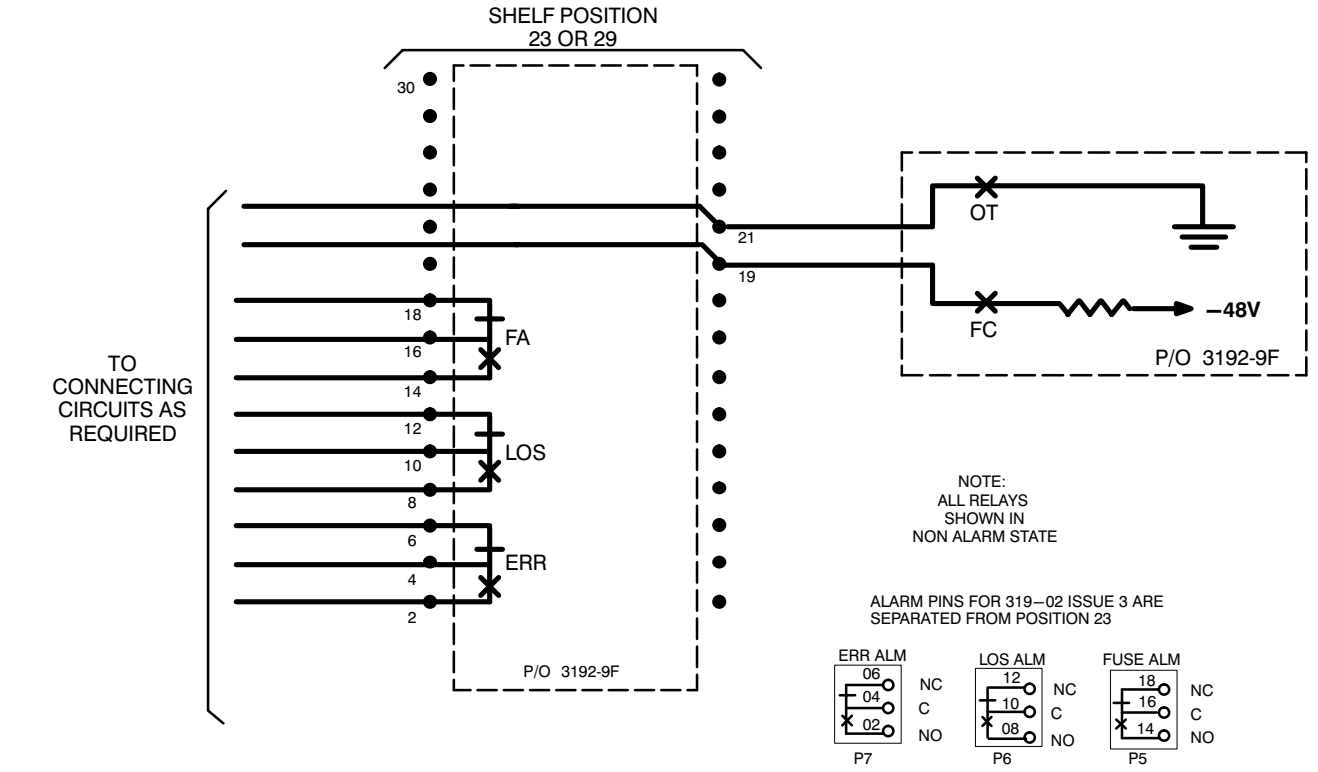


Figure 27. Wirewrap Shelf Assemblies 3192-WR and 319-04 (Rear View)



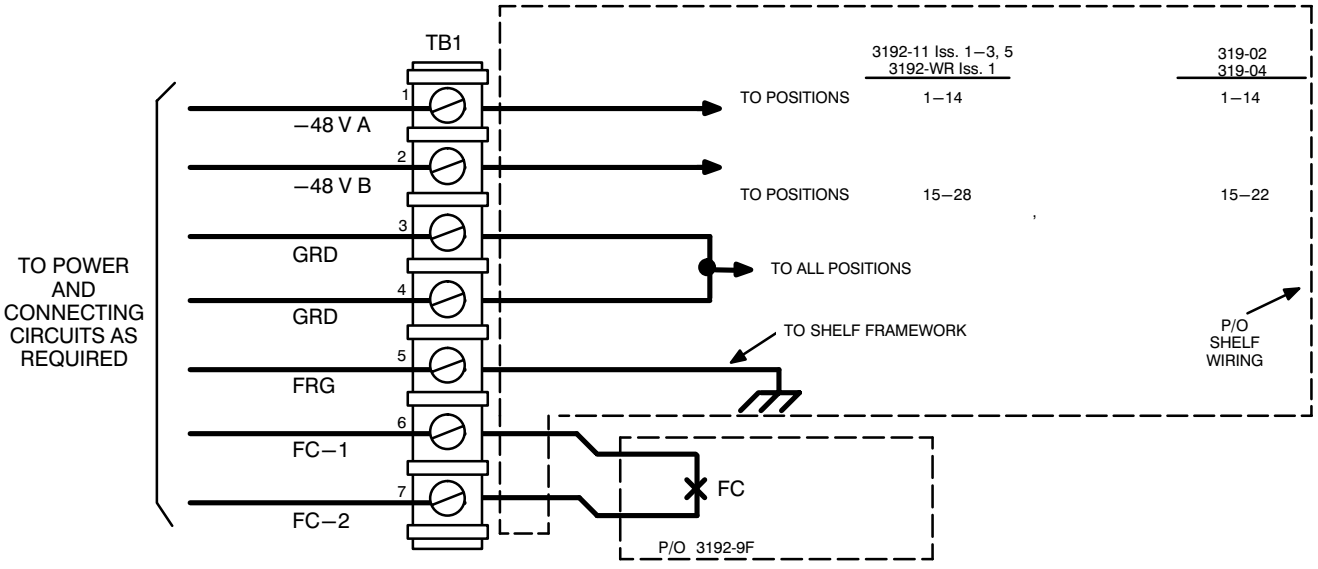


Figure 28. Power, Alarm and Miscellaneous Connections - All Shelf Assemblies

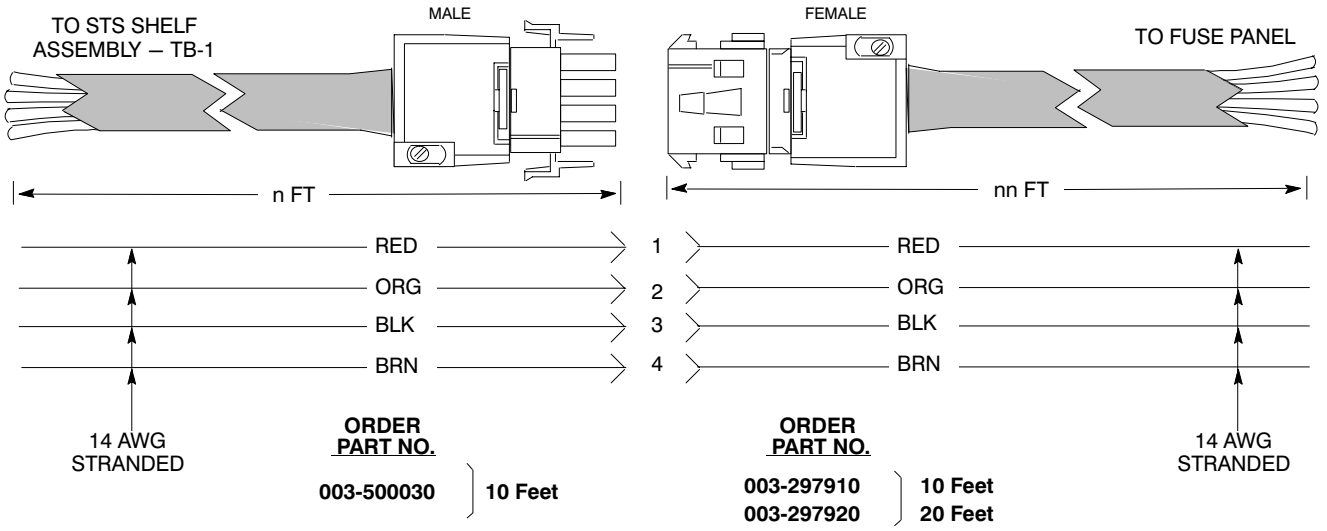


Figure 29. STS Power Cable Assemblies

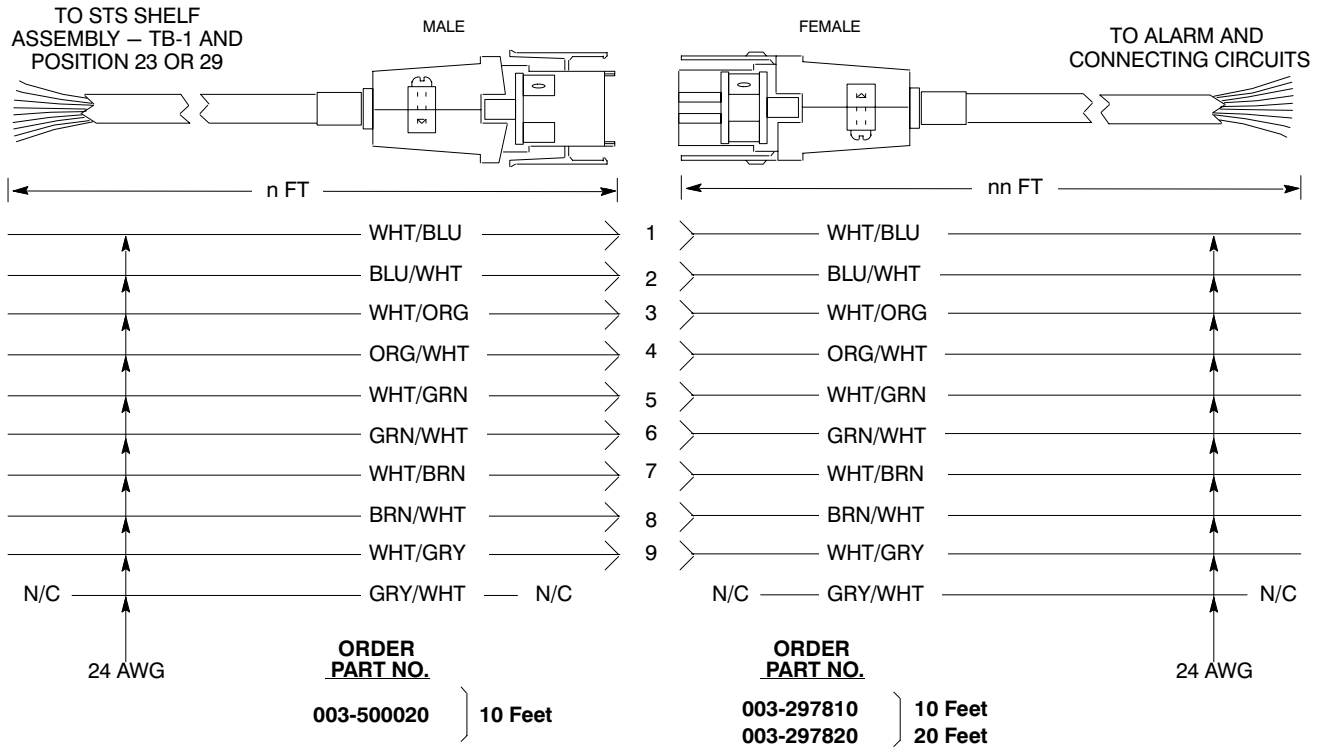


Figure 30. STS Alarm and Miscellaneous Cable Assemblies

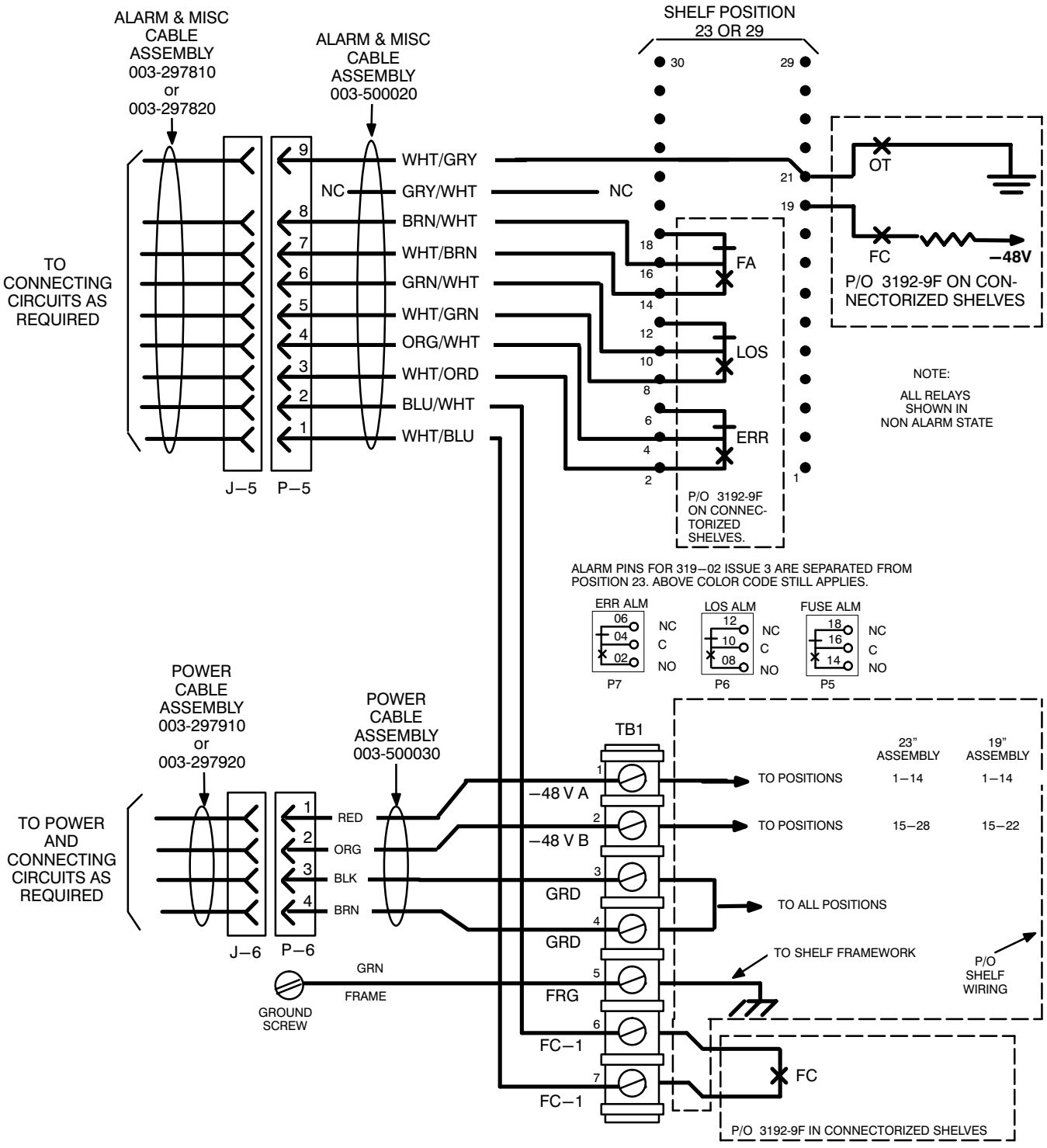


Figure 31. Power, Alarm and Miscellaneous Connections Using Cable Assemblies

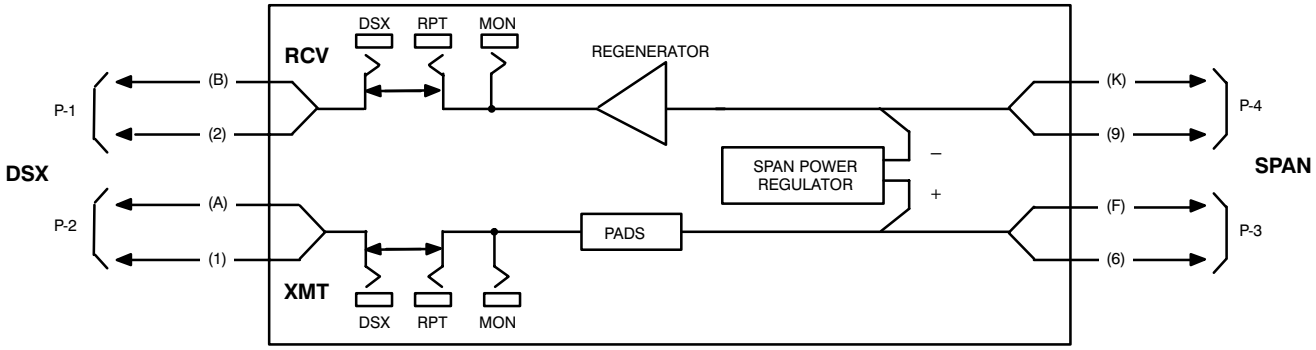


Figure 32. 3192-9L, 3192-9M, and 3192-9P Powering Office Repeaters (3192-9M does not provide test jacks)

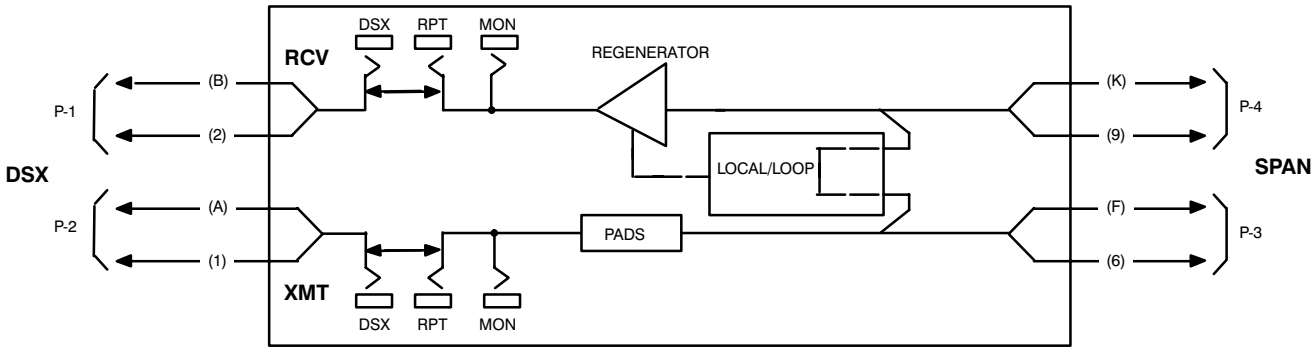


Figure 33. 3192-9T Terminating Office Repeater

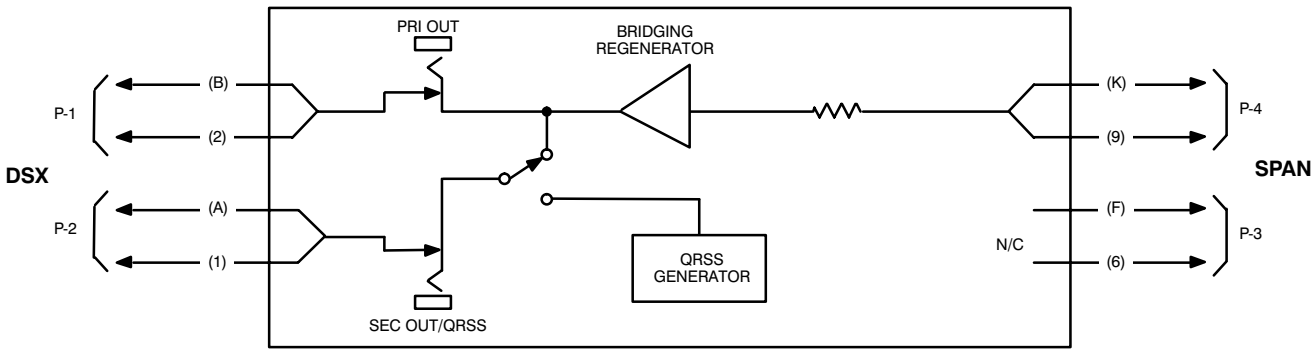


Figure 34. 3192-9B Bridging Office Repeater

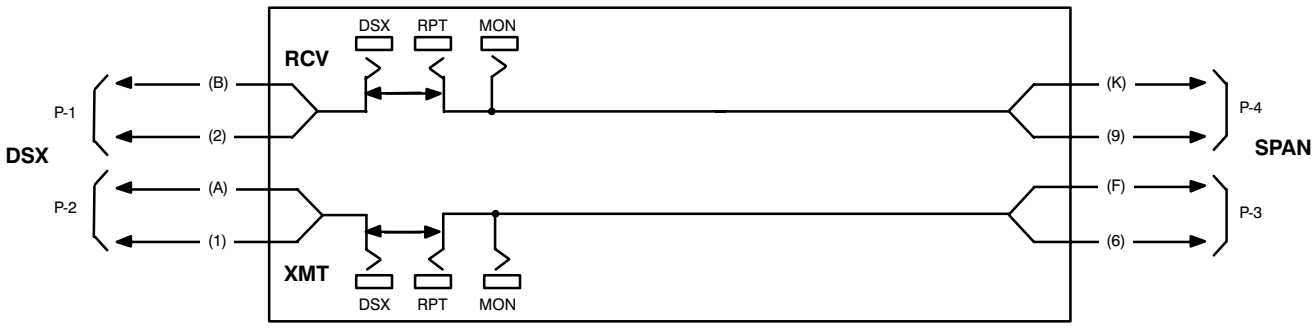


Figure 35. 3192-9C Cut–Thru Module

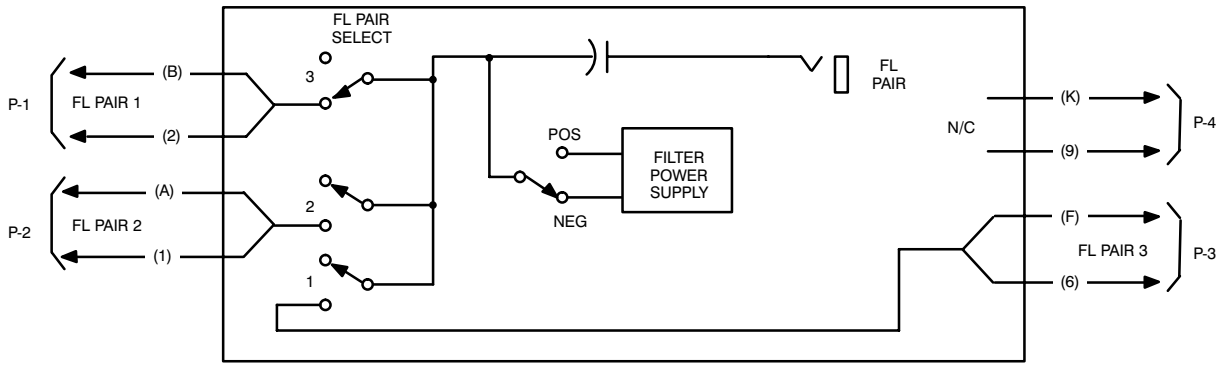


Figure 36. 3192-FL Fault Locate Unit

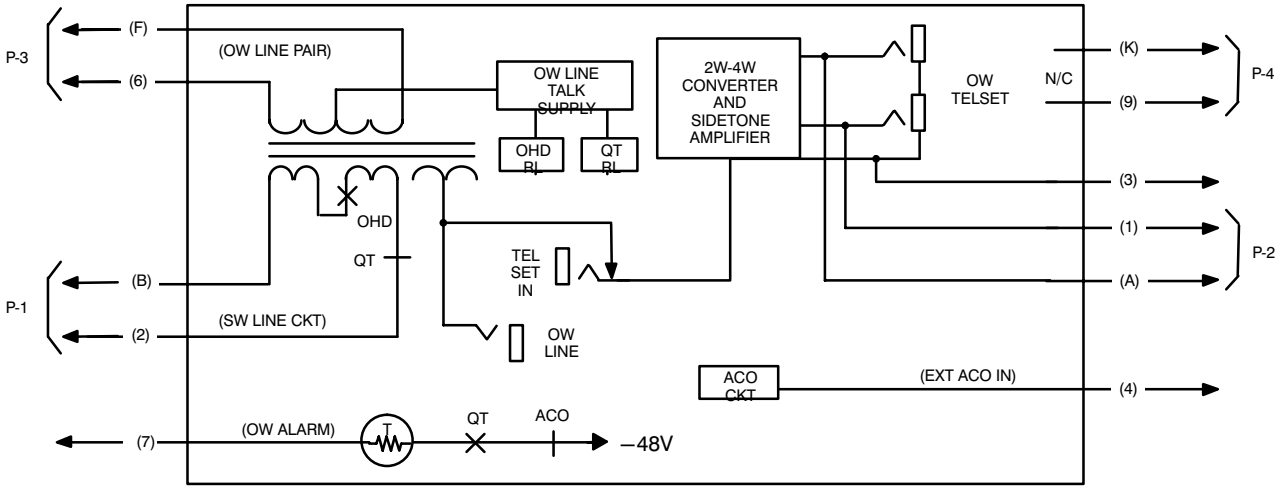


Figure 37. 3192-OW Order Wire Unit

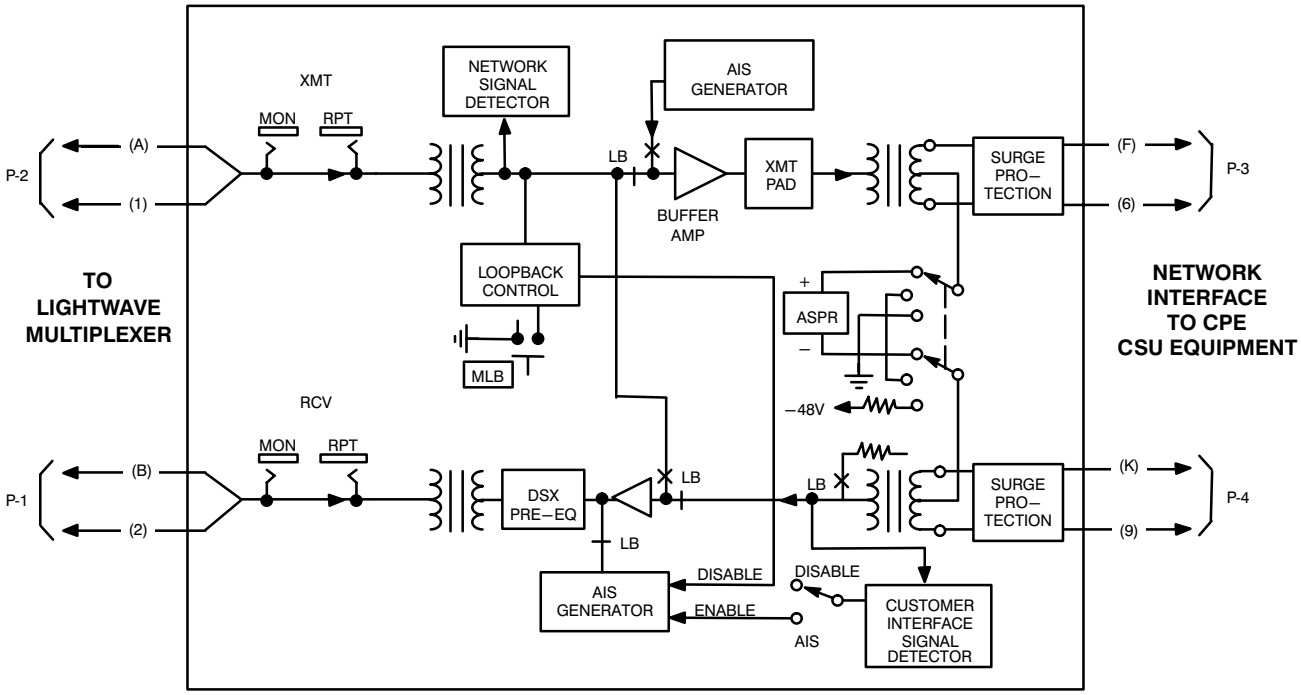


Figure 38. 3192-9E T1 Powering NIU

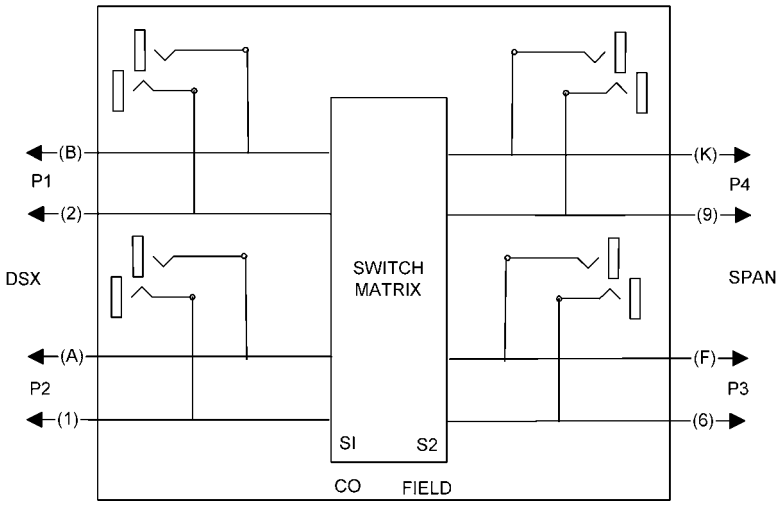


Figure 39. 3192TP Test Plug

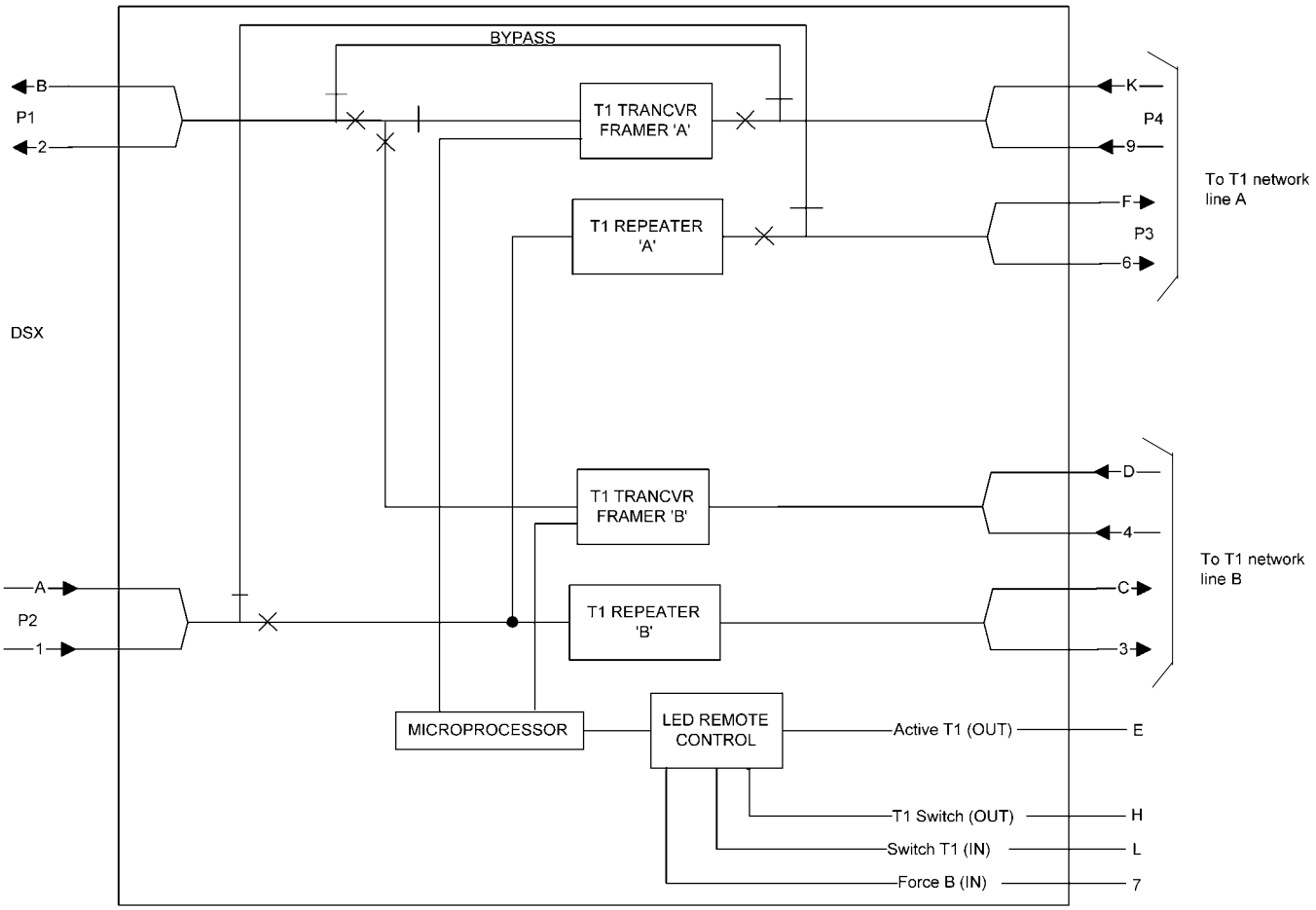


Figure 40. APS101 Automatic Span Protection Switch

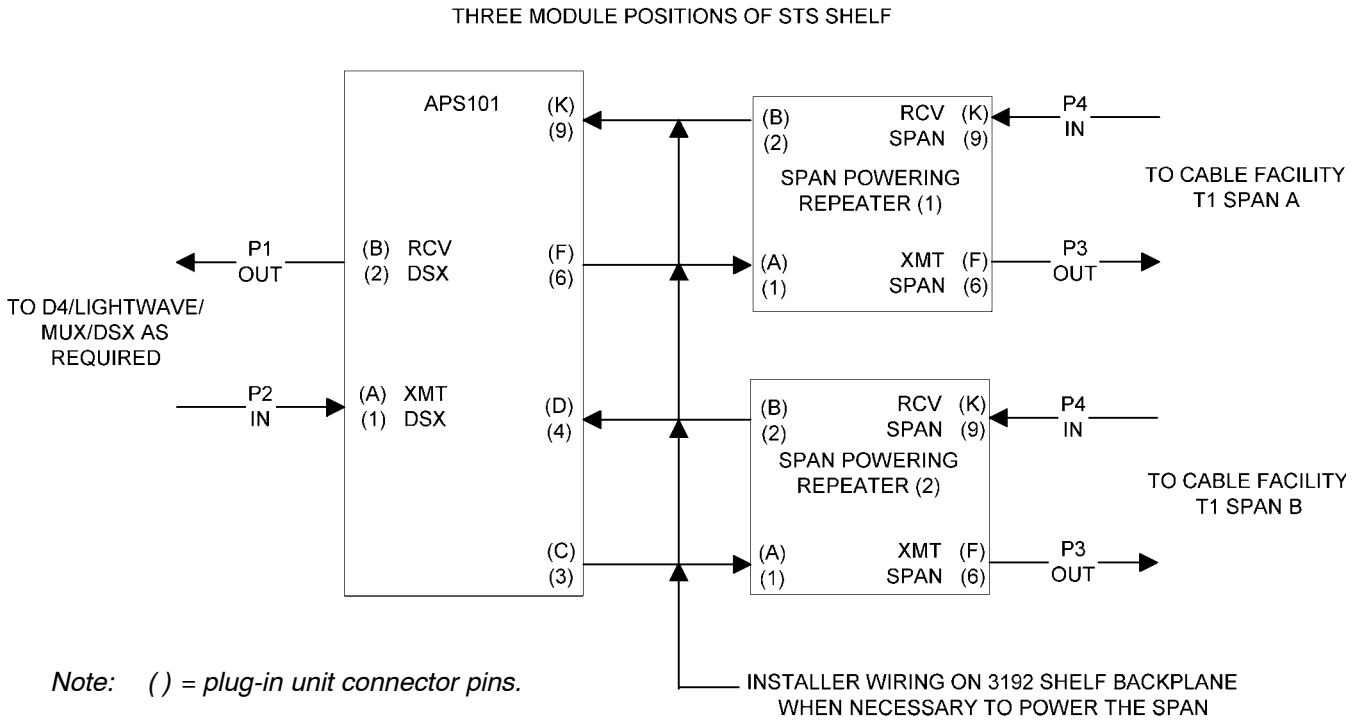


Figure 41. STS Wiring Cabling Convention using Automatic Protection Switch Module and 2 Each of the Span Powering Repeater

6. TECHNICAL ASSISTANCE

If technical assistance is required, contact Charles Industries' Technical Services Center at:

847–806–8500
847–806–8556 (FAX)
800–607–8500
techserv@charlesindustries.com (e-mail)

7. WARRANTY & CUSTOMER SERVICE

7.1 Warranty

Charles Industries, Ltd. offers an industry-leading, 5-year warranty on products manufactured by Charles Industries. Contact your local Sales Representative at the address or telephone numbers below for warranty details. The warranty provisions are subject to change without notice. The terms and conditions applicable to any specific sale of product shall be defined in the resulting sales contract.

Charles Industries, Ltd.
5600 Apollo Drive
Rolling Meadows, Illinois 60008–4049
847–806–6300 (Main Office)
847–806–6231 (FAX)

7.2 Field Repairs (In-Warranty Units)

Field repairs involving the replacement of components within a unit are not recommended and may void the warranty and compatibility with any applicable regulatory or agency requirements. If a unit needs repair, contact Charles Industries, Ltd. for replacement or repair instructions, or follow the *Repair Service Procedure* below.

7.3 Advanced Replacement Service (In-Warranty Units)

Charles Industries, Ltd. offers an “advanced replacement” service if a replacement unit is required as soon as possible. With this service, the unit will be shipped in the fastest manner consistent with the urgency of the situation. In most cases, there are no charges for in-warranty repairs, except for the transportation charges of the unit and for a testing and handling charge for units returned with no trouble found. Upon receipt of the advanced replacement unit, return the out-of-service unit in the carton in which the replacement was shipped, using the preaddressed shipping label provided. Call your customer service representative at the telephone number above for more details.

7.4 Standard Repair and Replacement Service (Both In-Warranty and Out-Of-Warranty Units)

Charles Industries, Ltd. offers a standard repair or exchange service for units either in- or out-of-warranty. With this service, units may be shipped to Charles Industries for either repair and quality testing or exchanged for a replacement unit, as determined by Charles Industries. Follow the *Repair Service Procedure* below to return units and to secure a repair or replacement. A handling charge applies for equipment returned with no trouble found. To obtain more details of this service and a schedule of prices, contact the CI Service Center at 217–932–5288 (FAX 217–932–2943).

Repair Service Procedure

1. Prepare, complete, and enclose a purchase order in the box with the equipment to be returned.

2. Include the following information:

   – Company name and address
   – Contact name and phone number
   – Inventory of equipment being shipped
   – Particulars as to the nature of the failure
   – Return shipping address

3. Ship the equipment, purchase order, and above-listed information, transportation prepaid, to the service center address shown below.

   CI Service Center
   503 N.E. 15th St, P.O. Box 339
   Casey, IL 62420–2054

4. Most repaired or replaced units will be returned within 30 or 45 days, depending on the product type and availability of repair parts. Repaired units are warranted for either 90 days from the date of repair or for the remaining unexpired portion of the original warranty, whichever is longer.