



RFL Electronics Inc.

INSTRUCTION DATA

RFL 9780/9785 Auxiliary Hybrid Chassis

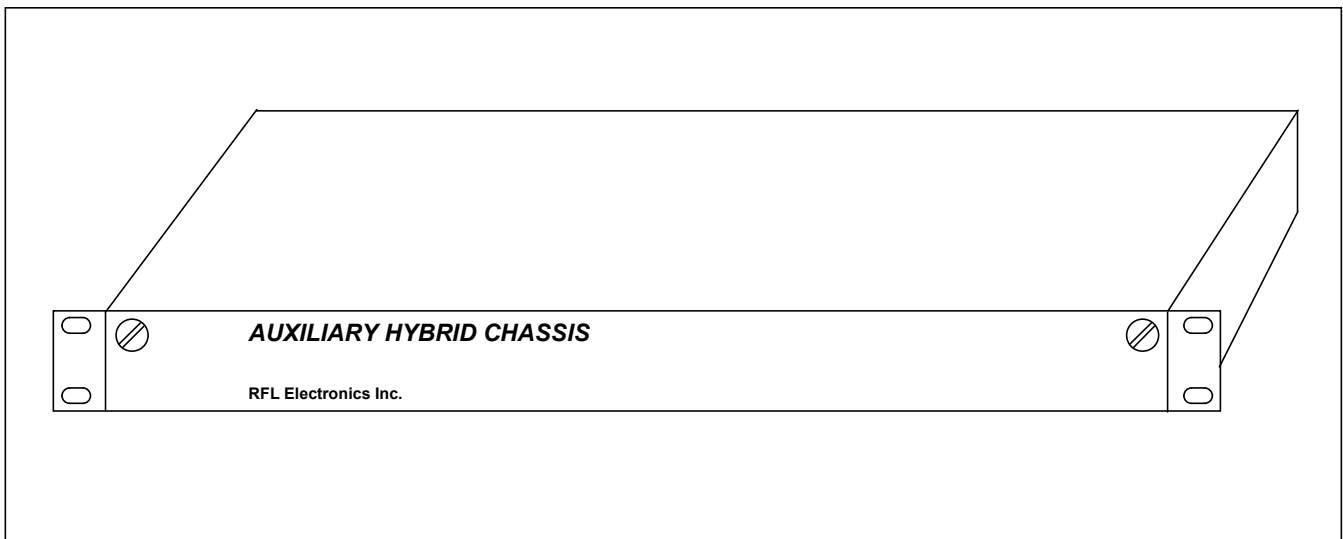


Figure 1. RFL 9780/85 Auxiliary Hybrid Chassis, front view

DESCRIPTION

Hybrids are optional modules for the RFL Powerline Carrier equipment. They may be used to combine combinations of transmitters and receivers to a single port for connection to line tuning units. There is an X-Hybrid Module and a Skewed Hybrid Module available. Each of these modules uses the same basic printed circuit board.

The Auxiliary Hybrid Chassis shown in Figure 1 is used to add X-Hybrid modules or Skewed Hybrid modules to RFL Powerline Carrier systems. Each Auxiliary Hybrid is contained in a 19-inch chassis that occupies less than one rack unit of vertical rack space (1.718 inches, or 4.4 cm). Each chassis can accommodate three Hybrid modules and three Hybrid I/O modules. The Hybrid modules are mounted in the front of the chassis, and the Hybrid I/O modules are mounted at the rear of the chassis. In a given chassis the Hybrid modules can be a mix of any combination of X-Hybrid modules or Skewed Hybrid modules.

X HYBRID MODULE

The X-Hybrid Module is a transformer-type hybrid typically used to combine the outputs of two transmitters. The X-Hybrid provides the required impedance matching and signal separation, and prevents mutual loading of the two transmitters. The impedance characteristics of the two types of X-Hybrid modules is shown in the table below.

Assembly Number	Receive	Send	Line
106630-1	50 Ohms	50 Ohms	50 Ohms
106630-2	50 Ohms	50 Ohms	75 Ohms

SPECIFICATIONS

As of the date this manual was published, the following specifications apply to all X-Hybrid Modules, except where indicated. Because all RFL products undergo constant refinement and improvement, these specifications are subject to change without notice.

Insertion Loss:

Approximately 3.5 dB, either input port to line output port.

Transhybrid Loss:

Greater than 25 dB, from 60 to 500 kHz, when operating with the specified termination impedances.

Power Capacity:

10 Watts rms.

Two-Wire Line Impedance:

50 Ohms standard; other impedances are available on special order.

Second Harmonic Distortion:

At least 80 dB below the fundamental frequency.

Third Order Intermodulation Products:

At least 60 dB below the fundamental frequency.

THEORY OF OPERATION

For this discussion, refer to the schematic diagram shown in Figure 3.

The X-Hybrid module is a transformer-type hybrid used to connect a transmitter and a receiver, or two receivers, to a single line tuning unit. It provides impedance matching and signal separation, and prevents mutual loading and interference. Signals can be accepted from an amplifier with a source impedance of 50 Ohms with up to 10 Watts of output power.

The transmitted signals pass through a transformer hybrid formed from transformers L1 and L2. These transformers each have two secondaries, interconnected so that the first secondary of one transformer is in series with the second secondary of the other. One set of interconnected secondaries is connected to the line tuning unit through edge connector A24/C24 (high) and A25/C25 (low). The other set of secondaries is connected across balancing resistors R13/R14 which determine the amount of isolation between four-wire ports.

The X hybrid can also be used to connect two transmitters to the same line tuning unit, resulting in dual-channel transmission capabilities. In this application, one transmitter is connected across the primary of L1, and the other transmitter is connected across the primary of L2.

CONTROLS AND INDICATORS

Figure 2 shows the location of all controls, indicators and components on the X-Hybrid Module. The controls and indicators are described in Table 1. Only TP5, TP6, TP7 and TP8 are accessible with the X-Hybrid Module installed in the chassis. All others are accessible when the module is removed from the chassis or is on a card extender.

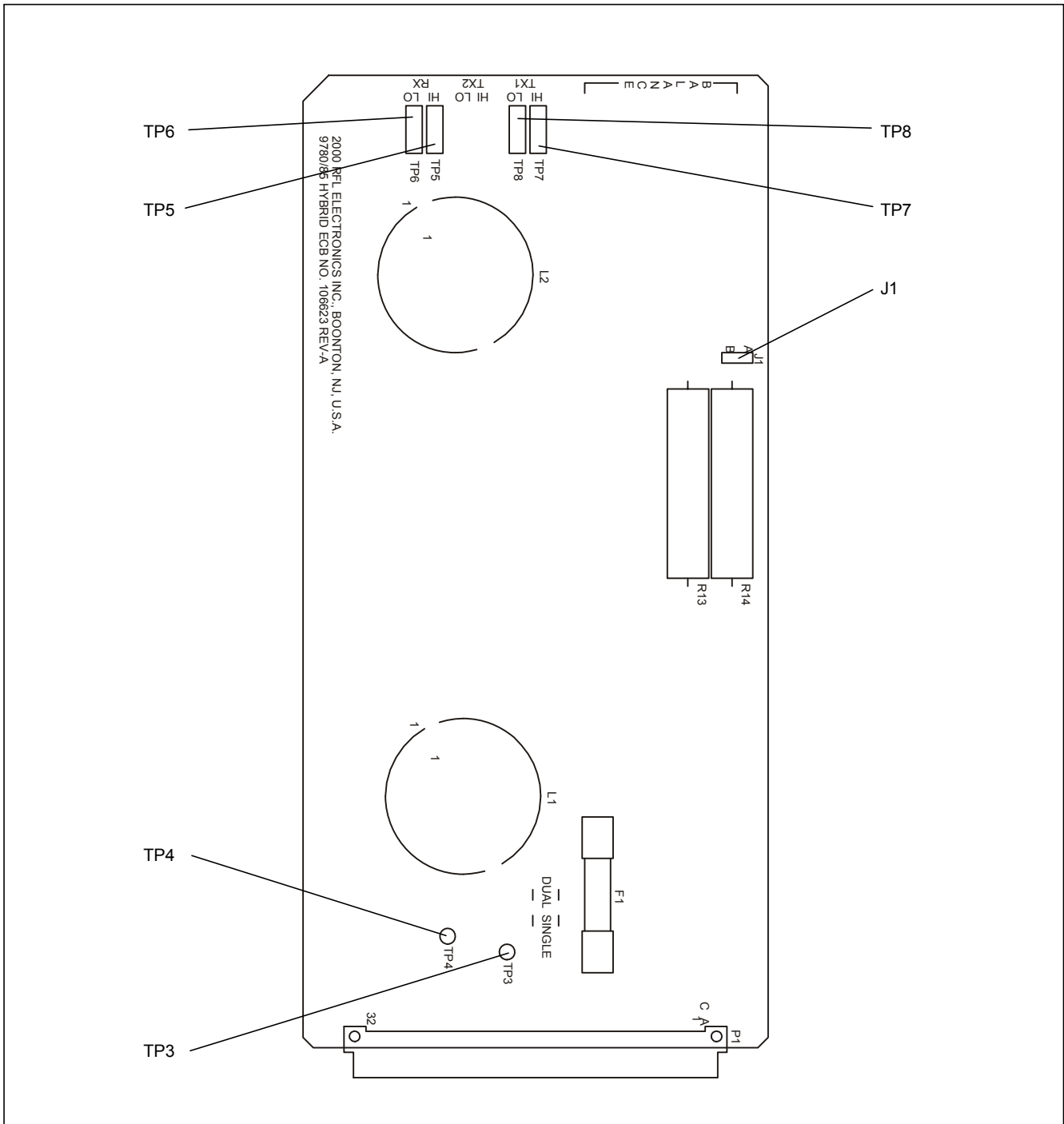


Figure 2. Controls, indicators, and component locations, X-Hybrid Module

Table 1. Controls and indicators, X-Hybrid Module

Component Designator	Name/Description	Function
J1	Jumper	Should always be in the A position.
TP3	Test point	Line High (orange)
TP4	Test point	Line Low (orange)
TP5	Test point	Receive High (green)
TP6	Test point	Receive low (yellow)
TP7	Test point	Send High (red)
TP8	Test point	Send Low (white)

**Table 2. Replaceable parts, X-Hybrid module
Assembly No. 106630-1 and -2**

Circuit Symbol (Figs. 2 & 3)	Description	Part Number
	MISCELLANEOUS COMPONENTS	
F1	Fuse, SLO-BLO, 10A, 32V, 3AG	10758
J1	Connector, header, single, 3CKT	32802 3
L1	Transformer, hybrid, 50 ohm, XMIT	
	106630-1	55768
	106630-2	55768
L2	Transformer, hybrid, 50 ohm, XMIT	
	106630-1	55768
	106630-2	55769
P1	Connector, JK, male, 64 contact, DIN	98457
R13, 14	Resistor, wirewound, 100Ω, 5%, 10W	100 795
TP3, 4	Test point terminal, orange	98441 3
TP5	Test point, green	38116 5
TP6	Test point, yellow	38116 8
TP7	Test point, red	38116 2
TP8	Test point, white	38116 1

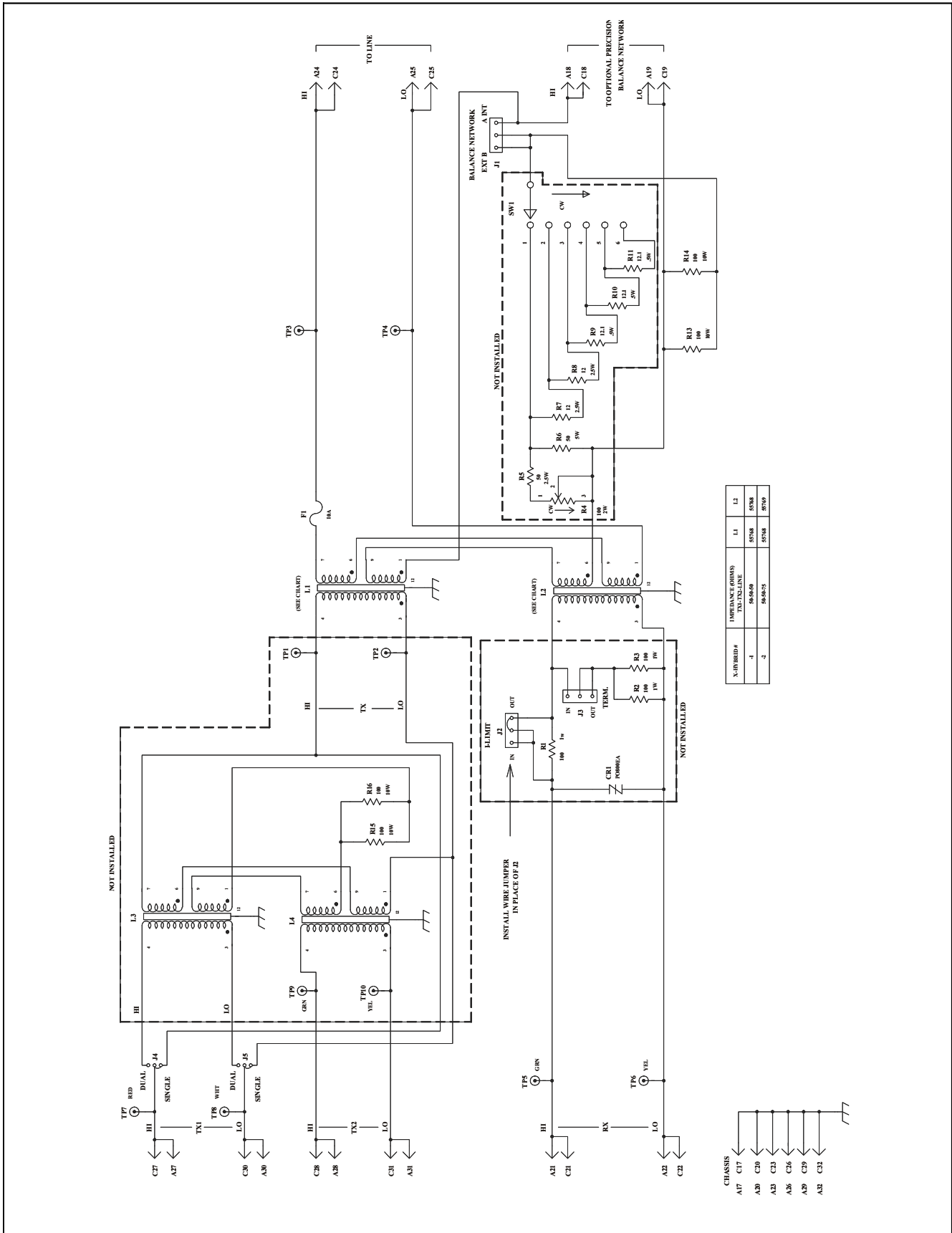


Figure 3. Schematic, RFL 9780/85 X-Hybrid (D-106634-A)

SKEWED HYBRID MODULE

The Skewed Hybrid Module uses two hybrid transformers to connect a transmitter and receiver to a single line tuning port. The Skewed Hybrid provides a high degree of signal separation by isolating the local transmitter signal from the local received signal and preventing the input impedance of the receiver from loading the transmitter. The impedance characteristics of the two types of Skewed-Hybrid modules is shown in the table below.

Assembly Number	Receive	Send	Line
106625-1	50 Ohms	50 Ohms	50 Ohms
106625-2	50 Ohms	50 Ohms	75 Ohms

SPECIFICATIONS

As of the date this manual was published, the following specifications apply to all Skewed Hybrid Modules, except where indicated. Because all RFL products undergo constant refinement and improvement, these specifications are subject to change without notice.

Insertion Loss (60 to 500 kHz):

Transmitting: Approximately 0.3 dB.

Receiving: Approximately 12.5 dB.

Transhybrid Loss (60 to 500 kHz):

Greater than 40 dB when operating with the specified termination impedance.

Internal Balance Range:

0.5 to 1.95 times the specified two-wire impedance.

Power Capacity:

10 Watts rms.

Two-Wire Line Impedance:

50 Ohms standard; other impedances are available on special order.

Second Harmonic Distortion:

At least 80 dB below the fundamental frequency.

Third Order Intermodulation Products:

At least 60 dB below the fundamental frequency.

THEORY OF OPERATION

For this discussion, refer to the schematic diagram shown in Figure 5.

The Skewed Hybrid Module uses two hybrid transformers to couple signals between a transmitter, a receiver, and a line tuning unit. It provides impedance matching and signal separation, and prevents mutual loading and interference. Signals can be accepted from an amplifier with a source impedance of 50 Ohms with up to 10 Watts of output power.

The transmitted and received signal passes through a hybrid formed from transformers L1 and L2. These transformers each have two secondaries, interconnected so that the first secondary of one transformer is in series with the second secondary of the other. One set of interconnected secondaries is connected to the line tuning unit through edge connector A24/C24 (high) and A25/C25 (low). This allows both the transmitter and the receiver to be coupled to the line tuning unit. The other set of secondaries is connected across the internal balancing network formed by resistors R4 through R11. The coarse balance switch SW1 and fine balance potentiometer R4 can be adjusted to vary the resistance across the transformer secondaries, which determines the amount of transhybrid loss.

The transmitter output is connected across the primary of L1, and the receiver input is connected across the primary of L2. Transmitter output signals are coupled through L1 to the line tuning unit, and incoming signals detected by the line tuning unit are coupled through L2 to the receiver. Transmitted signals are attenuated by about 0.3 dB as they pass through the Skewed Hybrid module, and received signals are attenuated by about 12.5 dB. Because both the received signal and its noise content are attenuated equally, signal-to-noise ratios are unaffected.

CONTROLS AND INDICATORS

Figure 4 shows the location of all controls, indicators and components on the Skewed Hybrid module. The controls and indicators are described in Table 3. Only TP5, TP6, TP7, TP8, SW1 and R4 are accessible with the Skewed Hybrid Module installed in the chassis. All others are accessible when the module is removed from the chassis or is on a card extender.

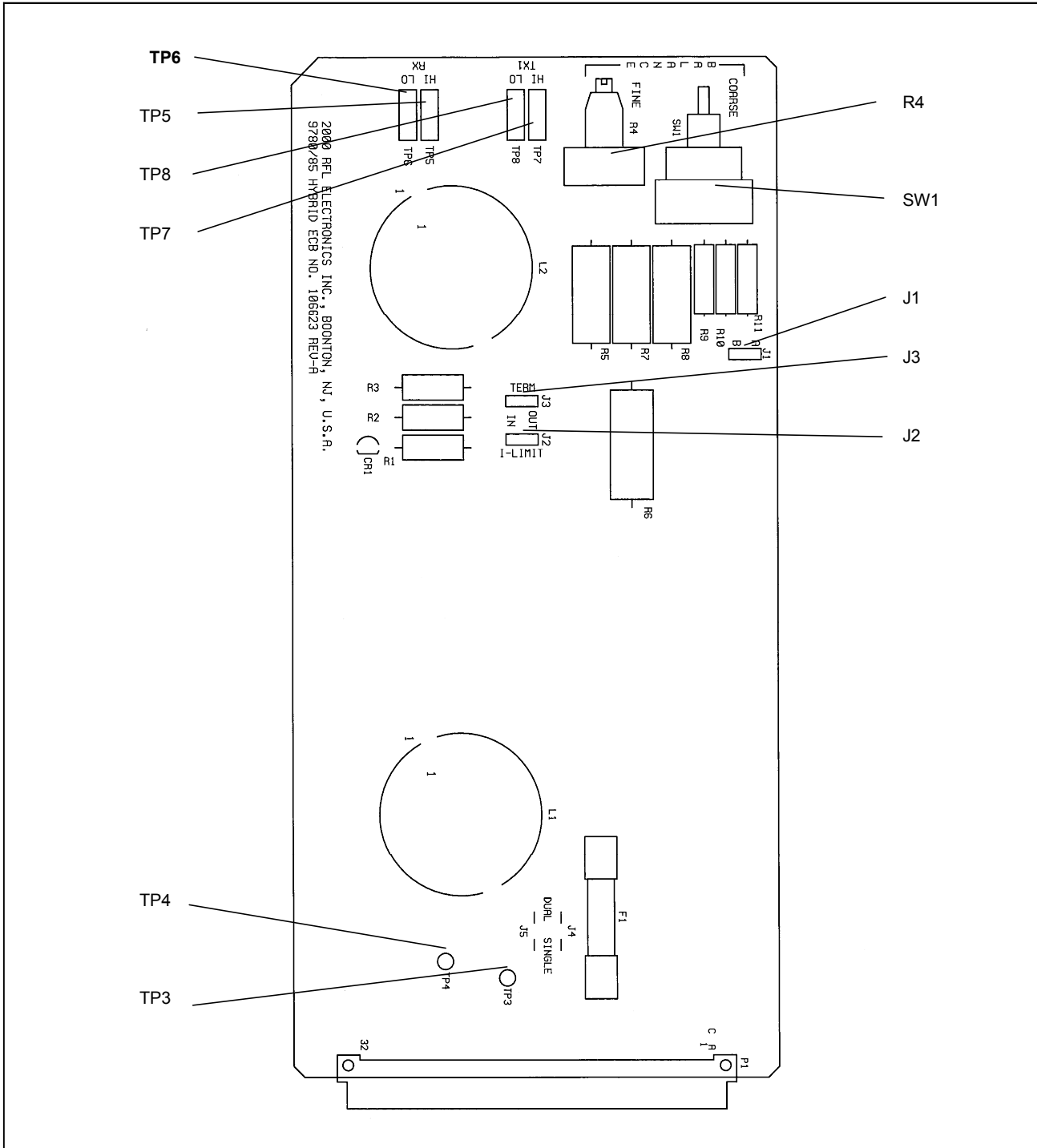


Figure 4. Controls, indicators, and component locations, Skewed Hybrid Module

Table 3. Controls and indicators, Skewed Hybrid Module

Component Designator	Name/Description	Function
J1	Jumper	Should always be in the A position
J2	Jumper	Enables the protection circuit with current limiting. The “IN” position enables current limiting. The “OUT” position disables current limiting.
J3	Jumper	Enables 50 Ohm termination. The “IN” position enables the termination. The “OUT” position disables the termination.
SW1	Switch	Coarse adjustment for balancing network
R4	Potentiometer	Fine adjustment for balancing network
TP3	Test point	Line High (orange)
TP4	Test point	Line Low (orange)
TP5	Test point	Receive High (green)
TP6	Test point	Receive low (yellow)
TP7	Test point	Send High (red)
TP8	Test point	Send Low (white)

SELECTING RECEIVE PORT PROTECTION AND TERMINATION

The receive port of the hybrid contains protection circuitry for the receiver’s front-end, and line termination resistance. These features are similar to those used in the RF Line I/O, and may be individually selected by using jumpers J2 and J3 as described in Table 3. Transient suppressor CR1 limits the voltage to the receiver and resistor R1 limits the current. Jumper J2 is used to bypass R1 when current limiting is not desired. J3 is used to enable the 50 Ohm termination resistance. The power dissipated by the termination should be limited to 1W.

The protection circuit should be placed as close as possible to the receiver and the termination should be placed at the end of the signal path. In a chassis with a single rear UHF connector, the termination and protection should be enabled (“IN”) on the hybrid. The received signal is then wired directly to the receiver circuits.

If the received signal is sent to a UHF connector on the line I/O (e.g. to go to another receiver), both the termination and protection should be omitted from the hybrid (“OUT”). The received signal out of the hybrid is sent to the line I/O’s UHF connector. Following the connector is the termination resistor. If this is the last, or only receiver using this signal, the termination on the I/O should be enabled. The protection circuit is always enabled on the I/O when connected to the local receiver, to protect the local receiver. This configuration protects the receiver from line disturbances passed through the hybrid and also protects against any transients applied to the UHF connector.

The termination must never follow any current limit resistance. The signal should be wired directly from the protection circuit to the receiver, and each receiver should have protection.

**Table 4. Replaceable parts, Skewed Hybrid Module
Assembly No. 106625-1 and -2**

Circuit Symbol (Figs. 4 & 5)	Description	Part Number
MISCELLANEOUS COMPONENTS		
CR1	Suppressor, transient, bidirectional. 75V	101473
F1	Fuse, SLO-BLO, 10A, 32V, 3AG	10758
J1-J3	Connector, header, single, 3CKT	32802 3
L1	Transformer, hybrid, 50 ohm, XMIT 106625-1	55766
	106625-2	55865
L2	Transformer, hybrid, 50 ohm, XMIT 106625-1	55766
	106625-2	55865
P1	Connector, JK, male, 64 contact, DIN	98457
R1-3	Resistor, fixed composition, 100Ω, 5%, 1W	1009 182
R4	Resistor, metal film, variable, 100Ω, 10%, 2W	44356
R5	Resistor, wirewound, 50Ω, 5%, 2.5W	1100 747
R6	Resistor, wirewound, 50Ω, 5%, 5W	1100 748
R7, 8	Resistor, wirewound, 12Ω, 5%, 2.5W	1100 745
R9, 10, 11	Resistor, metal film, precision, 12.1Ω, 1%, 1/2W	1510 2109
SW1	Switch, rotary, 1 deck, 6 position	44357
TP3, 4	Test point terminal, orange	98441 3
TP5	Test point, green	38116 5
TP6	Test point, yellow	38116 8
TP7	Test point, red	38116 2
TP8	Test point, white	38116 1

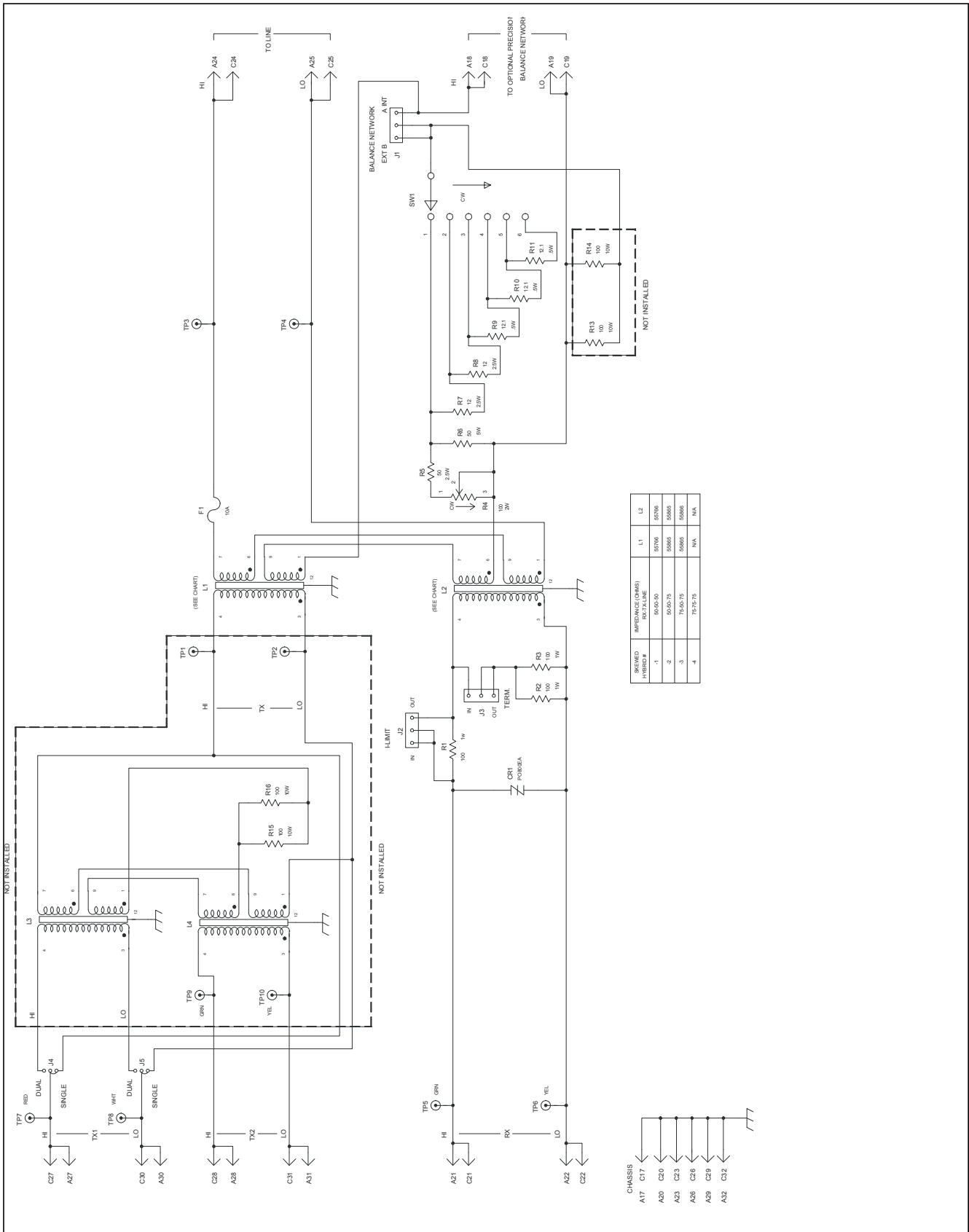


Figure 5. RFL 9780/85 Skewed Hybrid (D-106629-A)

HYBRID I/O

The Hybrid I/O module provides three BNC connectors. All three have a spark gap protection device. The middle port (J2) is the line port for both the X-Hybrid and the Skewed Hybrid. Ports J1 and J3 are TX (input) ports when an X-Hybrid is connected. J1 is the TX (input) port and J3 is the RX (output) port when the Skewed Hybrid is connected.

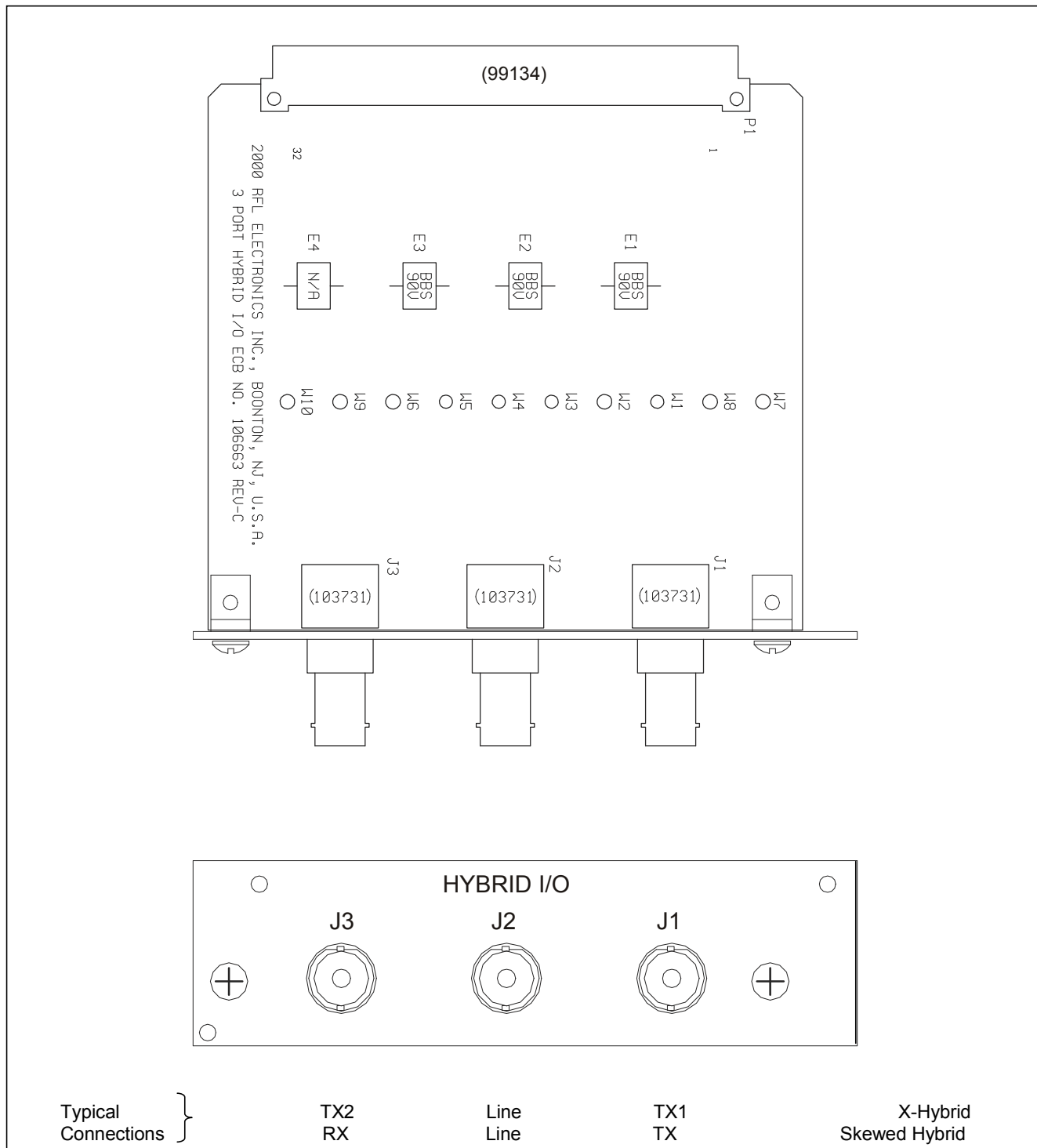


Figure 6. RFL 9780 3-Port Hybrid I/O (C-106660-C)

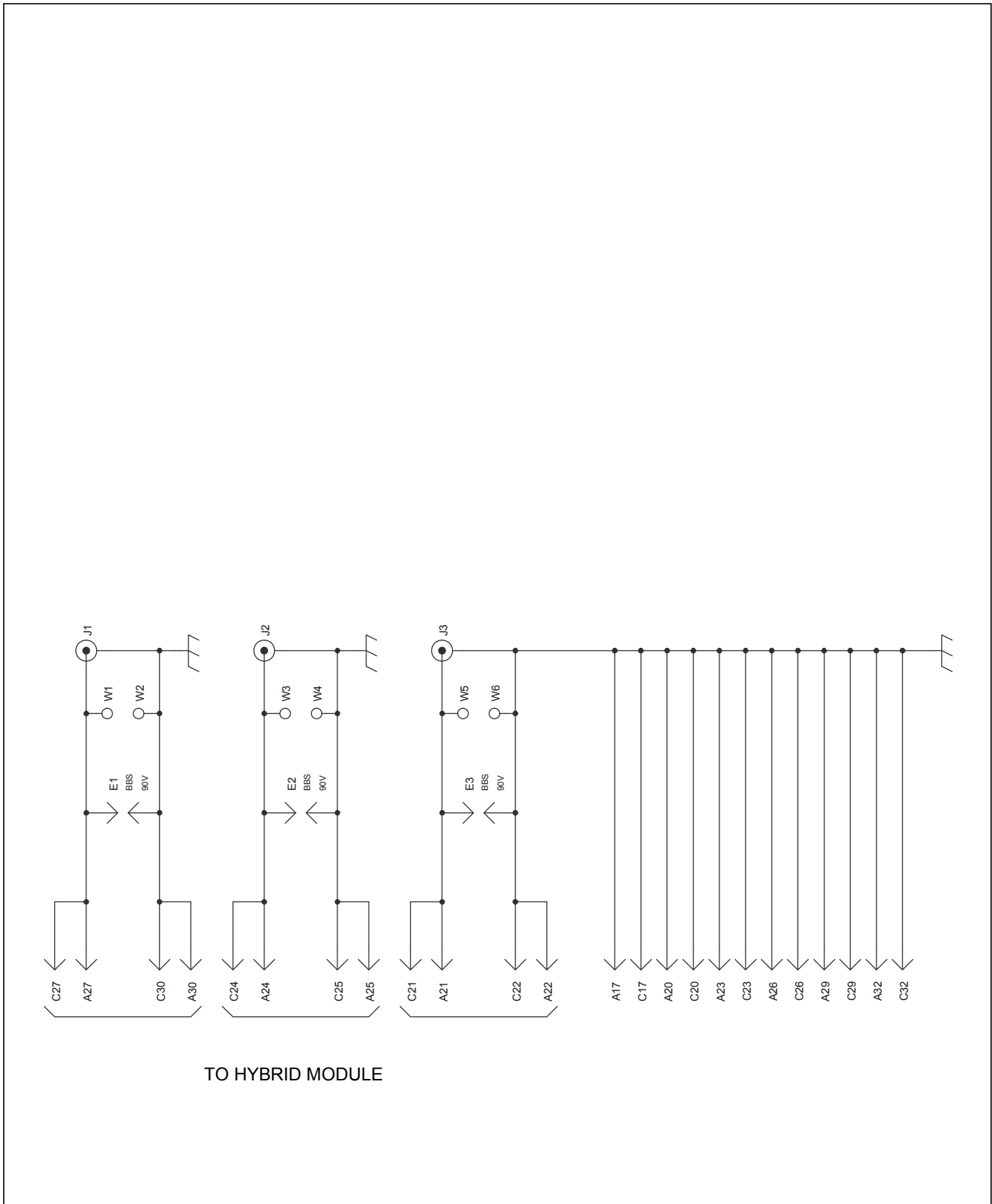


Figure 7. Schematic, RFL 9780/85 3-Port Hybrid I/O (C-106664-C)

**RFL Model 9780/9785 One Rack Unit Hybrid Chassis
Smart Number Ordering Information**

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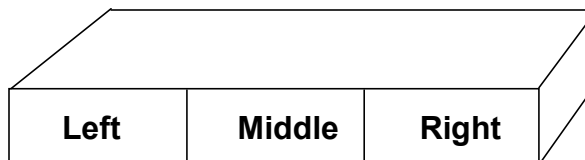
Chassis	
1 Rack Unit Chassis	HYB

Left Position	
Blank Panels	B
Transformer Hybrid	T
Skewed Hybrid	S

Middle Position	
Blank Panels	B
Transformer Hybrid	T
Skewed Hybrid	S

Right Position	
Blank Panels	B
Transformer Hybrid	T
Skewed Hybrid	S

Note:
Left, Middle, and Right chassis positions are as viewed from the front of the chassis



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