



SOLUTIONS FOR AN EVOLVING WORLD

RFL 9508

DSP POWERLINE
CARRIER SYSTEM



A tall, dark lattice tower, likely a telecommunications or power tower, stands against a vibrant sunset sky. The sun is low on the horizon, creating a warm orange and yellow glow. The tower's structure is silhouetted against the bright sky. In the background, some trees and distant structures are visible under the sunset light.

Your world is changing and so are we.

At RFL, we know your needs change much faster than your infrastructure. Our comprehensive line of solutions meets you wherever you are to help you bridge the gap from yesterday to tomorrow.

We aren't just engineering products. We are continuously innovating to give legacy equipment the advantage of today's technologies. Our highly adaptable solutions offer more features for more flexibility and a custom fit for your specific needs.

When we deliver, we also deliver our reputation. So when you open that box, you're opening a custom-engineered solution, factory-tested and ready for deployment.

And as long as you own that equipment, you own the attention of RFL. We see you as our partner and we want to ensure that our solution is working for you – now and over the long haul. RFL – delivering solutions that work. Period.

RFL 9508 DSP Powerline Carrier System



Product Description

The RFL 9508 is a highly integrated and state of the art PLC terminal which incorporates Digital Signal Processing technology (DSP) to increase reliability and flexibility, while reducing physical size. Furthermore, the mechanical arrangement has been simplified for easier installation and maintenance.

These terminals offer a choice of two power output levels, and a wide range of options which include the choice of PLC, E1 or T1. Plug-in teleprotection modules are available to complete an integrated communication system design.

All channels are capable of Drop and Insert operation at the analog or digital T1/E1 level. These features make for a unique product that is ultimately flexible.

The frequency range is 20 kHz to 500 kHz. Single Side Band (SSB) modulation is used for the RFL 9508 where the use of the spectrum is optimized with high quality adjacent channel selectivity. Idle channel noise, cross-talk and spurious outputs are minimized and high frequency stability over the specified temperature range is achieved.

The equipment is designed to operate in the harsh environment of electric utility substations and is based, in part, on the successful and proven RFL IMUX 2000 T1/E1 multiplexer family of products.

An integrated orderwire service channel is included in the standard system. It features an adjustable volume control and audible ARD tone at the far end when the handset is taken off the hook at the near end.

Key Features & Benefits

Interconnection between a Power Line Carrier and any existing or new T1/E1 Network.

IEC60495 and IEC60834-1 standards exceeded.

Programmable for 2.5 kHz or 4 kHz operation.

AF and RF functionality 100% programmable through a Windows® Interface.

50 or 100 Watt PEP output power.

Up to 8 independent commands of integrated transfer trip.

20 kHz - 500 kHz frequency range with no components to change in the field.

General Specifications

The equipment consists of the following stages:

Stage 0:

This level comprises the I/O cards, such as the VF Channel Card, Power Supply, and Teleprotection card (PLC-TT).

Stage 1:

DSP Transceiver, loaded with the firmware to produce SSB analog PLC and Multitone F6 Teleprotection.

Stage 2:

Power Amplifier, PA Power Supply, RX Filter, TX Filter, Hybrid

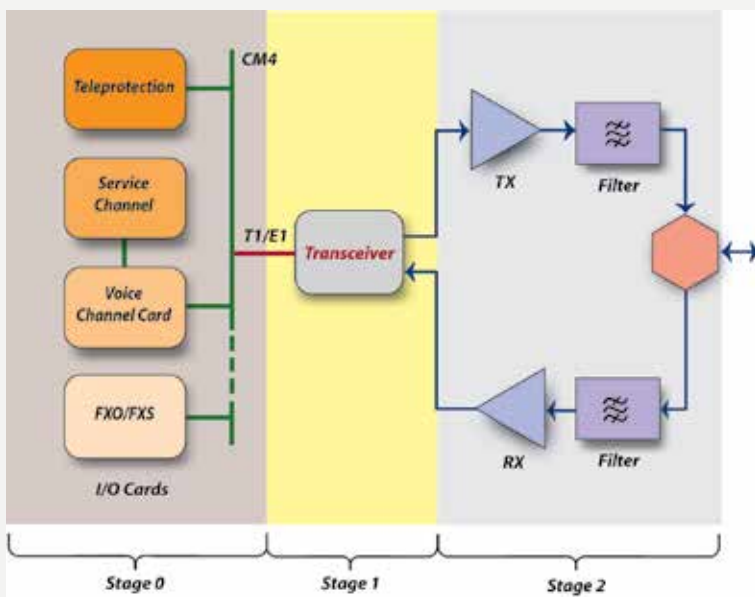


Figure 1. Equipment Stages

Modulation Scheme

The most recent improvements asserted in the RFL 9508 are oriented to the practical and easy frequency planning and customization of the PLC equipment on site, involving full RF & Audio field programming. The latest digital devices such as the DUC (Digital Up Converter) allow one step modulation from audio level to RF; the DDC (Digital Down Converter) allows one step demodulation from RF to the audio level with a bandwidth of 2.5 kHz or 4.0 kHz, as shown in the example for the modulation scheme in Figure 2.

Each 0-2.5 or 0-4 kHz block in Figure 2 represents a single audio channel, and each channel can be utilized in many different ways as covered under Application Notes. To conserve spectrum, each channel is positioned side by side in the frequency spectrum.

A versatile Windows® GUI (Graphics User Interface), allows the user to configure the system requirements, mapping 64kbps channels from the T1/E1 frame into the frequency spectrum.

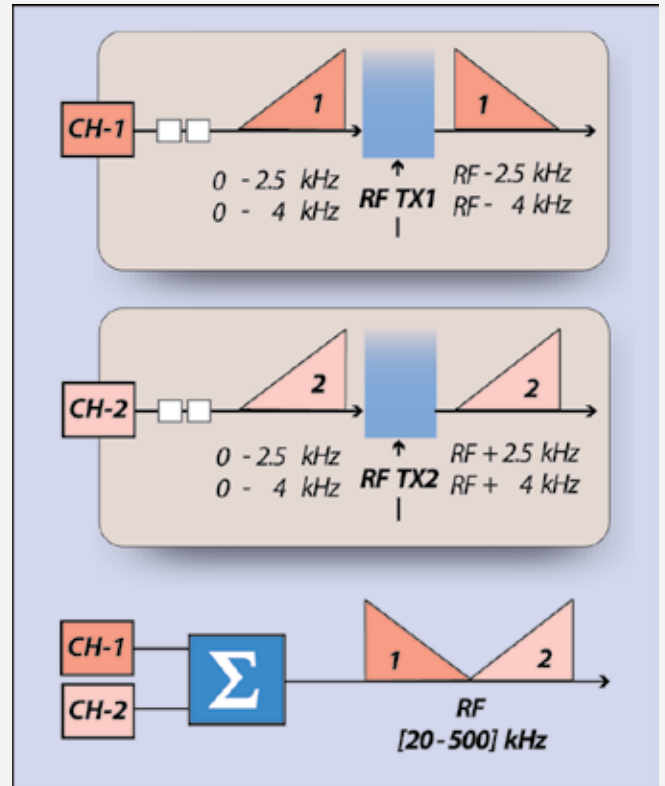


Figure 2. Modulation Scheme

Channel Utilization

Figure 3 shows some of the combinations of functions that can be applied within each 0 to 2.5 kHz or 0 to 4 kHz channel in a PLC system. It is obvious from these diagrams that many other combinations are possible, which gives considerable flexibility in the utilization of the RFL 9508.

The RFL 9508 channels share both voice and tele-control signals. The telecontrol signals are representative of a Multi-tone system. Note in figure 3-D, that the trip signals are located in the voice spectrum of the PLC channel, and the voice and telecontrol tones are blocked during transmission of the trip signals.

The Transceiver includes a user programmable low pass filter to separate the speech and speech-plus bands. The filter has a programmable cut-off frequency from 1800 to 3400 Hz. The VF-5XP voice module contains a 4 wire interface for speech and a 4 wire interface for speech-plus. Up to four VF-5XP modules can be used in a RFL 9508. The available bandwidth for speech-plus is 300Hz to 3,700Hz.

A low delay audio path is included to allow the use of RFL 9745 Audio Teleprotection.

General Specifications (continued)

An integrated F6 four function teleprotection system is also available. Up to two four-function modules can be used with the RFL 9508 providing a maximum of eight transfer trip functions.

The 4W E&M signaling is supported end to end via the PLC pilot tones.

Applications

The RFL 9508 has been designed to satisfy all the requirements for a Power Line Carrier System, and by means of the Drop and Insert feature the RFL 9508 can integrate a Power Line Carrier channel with a Digital T1 or E1 frame using either a Fiber Optic or an Electrical Interface.

Figures 4 and 5 show a typical application of an RFL 9508 in a system. This illustrates a power line carrier system with the use of T1 or E1 and digital repeaters. In this case a three-way repeater is depicted. Any combination can be used together in a system to provide excellent communication quality over long distances with many repeats.

This illustration also describes baseband repeating. Repeating can also be accomplished by bringing all channels down to audio frequencies and repeating them on this basis, which is the more common practice.

Digital repeaters offer distinct economic and technical advantages over audio repeaters because a digital repeater is made digitally at 1.54 or 2 Mbps; consequently, an audio repeater always requires two repeaters per channel and an increase in the Group Delay.

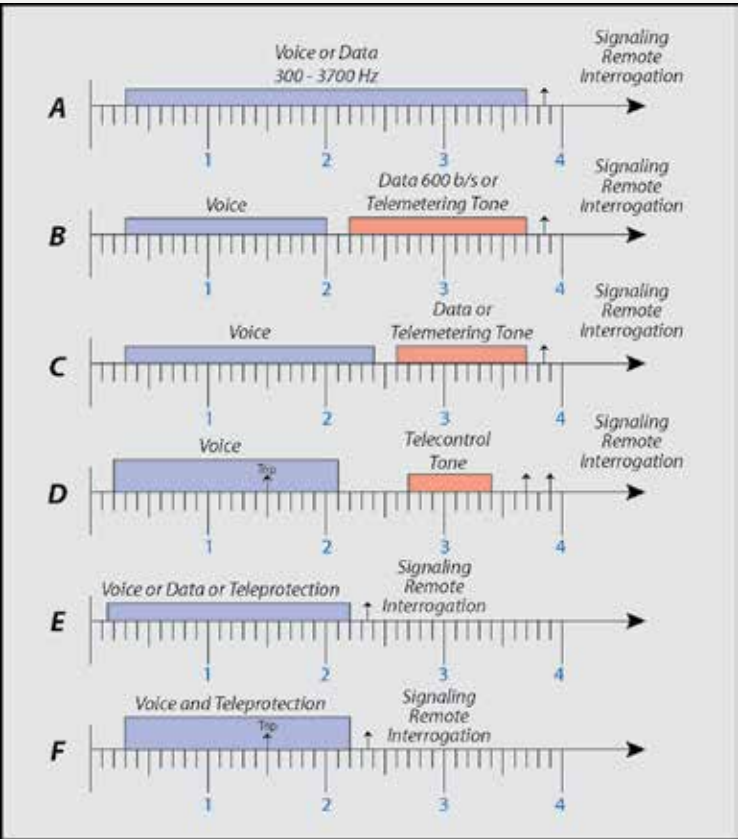


Figure 3. Channel Utilization

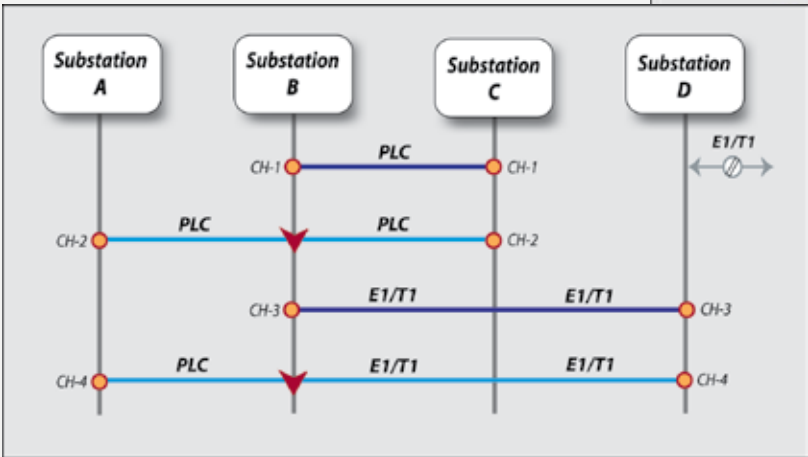


Figure 5. Typical Application

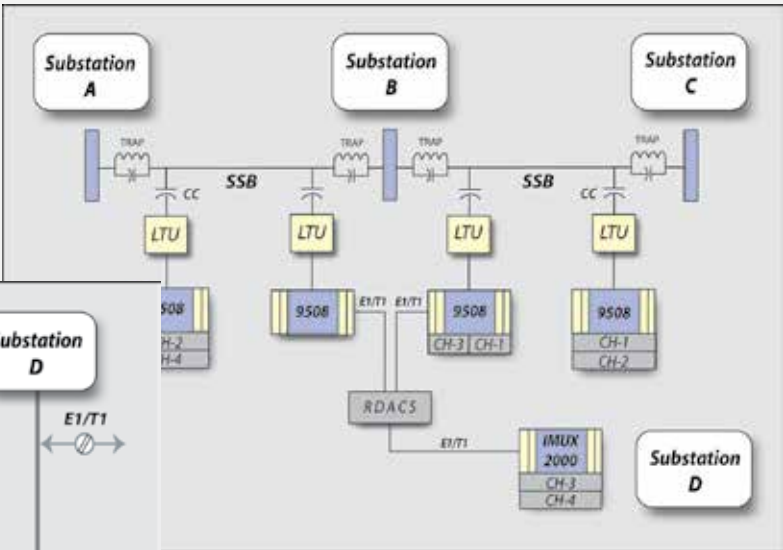


Figure 4. Typical Application

Specifications subject to change without notice.

Block Diagrams

System Architecture

The modularity of the RFL 9508 allows high flexibility to comply with different requirements; the main modules are:

Transceiver: Communications Unit, digital processing and converting the audio frequency signals either to SSB or T1/E1.

Power Amplifier, 50 or 100 Watts Peak Envelope Power (PEP.)

Coupling: RF Filters, Hybrid, Dummy Load, Loop Back Test

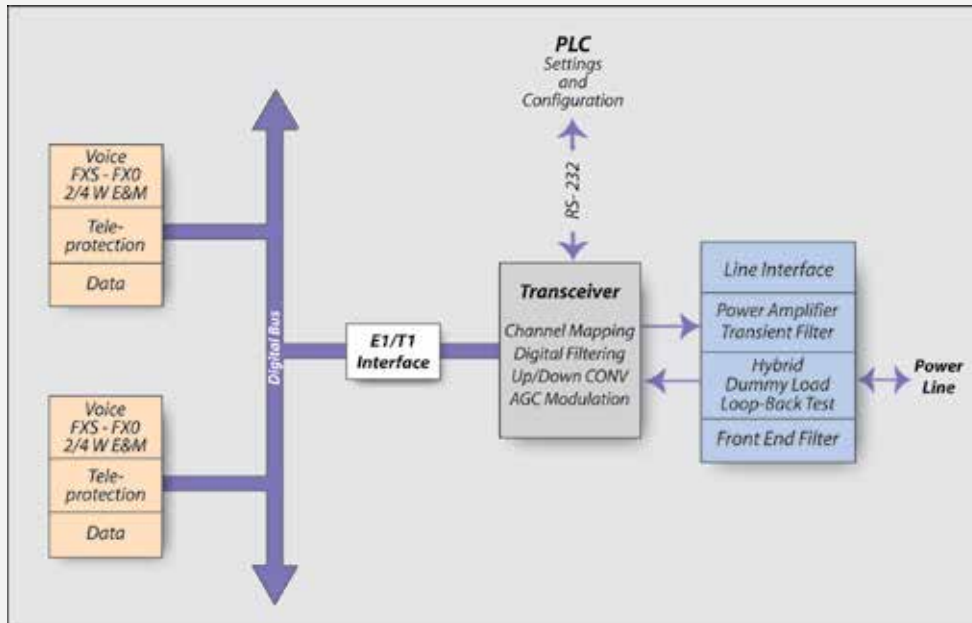


Figure 6. RFL 9508 System Architecture

Detailed Functionality

Transceiver

The Power Line Carrier Transmitter and Receiver module, includes the Modulator and Demodulator, Digital Filtering, Numerical Control Oscillator (NCO), Analog and Digital Channel Mapping and RS232 interface for configuration.

This module has many functions as follows:

- Translate and convert the digital baseband source from the T1/E1 digital frame into the frequency range from 20 to 500 kHz.

- Translate and convert the Line Frequencies into digital baseband or the T1/E1 digital frame.

- Communicate with other T1/E1 modules using the CM-4 to provide a multichannel system.

- Perform line frequency programming, setting of the speech plus filters, configuration, RS232 Network Management System (NMS) Interface, diagnostics, impedance matching and level adjustment for SSB Transmission and Reception.

- Automatic Gain Control (AGC) to compensate for variations in signal level caused by line attenuation changes. If the received signal level varies more than 40 dB from normal in the regulation range of -20 to +20 dB or -26 to +14 dB, a relay and LED will indicate an alarm. Additionally the AGC functions to perform the signal-to-noise squelch which disables the system and initiates an alarm under excessive noise conditions.

Architecture of AF Chassis

The Transceiver and the IMUX Common Module are mounted in a 19" wide chassis. The connection between the two is an E1 or T1 link with shared RS232 port and power. The CM4 common card, PLC-TT card and voice speech plus card are in the IMUX side of the chassis while the transceiver is on the PLC side of the chassis.

Programmable RF Test Generator

The Transceiver can generate an RF test tone between 20 and 500 kHz to be transmitted over the SSB path.

RF Chassis

The RF chassis comprises the RF skewed Hybrid, RF Impedance Adapter, Loop Back Test Module, Dummy Load, Power Monitor, and 50W power amp.

The RF Interface is located at the top in the RF chassis. Test points are found inside the front panel: Line TX (after transmit filter), Line RX (before front-end filter) and Line (after the Hybrid). These signals facilitate equipment testing and commissioning.

The Skewed Hybrid efficiently separates the send and receive frequencies. Use of a skewed hybrid keeps losses in the send direction very low (0.5 to 1 dB).

Analog and Digital Interfaces

The RFL 9508 has many interfaces that are also used with the RFL IMUX 2000 family of T1/E1 multiplexers. The following interfaces are available:

Analog Interface Modules:

VF-5XP Voice Module

This module provides either one or two voice grade channels, with high quality voice characteristics and extended range input/output level adjustments. The VF-5XP uses Pulse Code Modulation (PCM) coding with each voice channel occupying from 1 to 3 64 kbps* time slots for transmission over the powerline by the PLC transceiver in the RFL 9508. Jumpers on the module allow the user to select E&M Type I, II, III, and V signaling, with front panel status indicators and front panel bantam jacks to provide test access.

There are a variety of I/O module adapters available that include the following:

MA-301A	Surge Isolated 4W Terminal Block I/O
MA-301B	Screw Compression I/O

The module can be configured as follows:

Two Channels of 300 Hz - 2,200 Hz (or 300Hz - 3,400Hz) Voice Grade Channels. If the PLC application is only a single channel system, the second channel will not be available.

One Channel of Speech and Speech-Plus, the audio range of each is programmable to suit the application need.

*1 - 64 kbs time slot for a 300 Hz - 2,200 Hz (or 300-3,400 Hz) voice channel or 3 - 64 kbs time slots if the channel is to be divided into a Speech and Speech-Plus channel.

VF-6I Single Channel Four-Wire Order Wire Module

The RFL VF-6I Orderwire Module provides multi-drop (party line) communications link between facilities using a single time slot. The module may be used in a RFL 9508 when it is configured as an end terminal, or as a drop and insert terminal connected electrically or optically to an IMUX 2000 T1/E1 multiplexer. The unit uses m-Law companding and may be configured to transmit in either or both bus directions. The signaling is either CAS (E1) or RBS (T1), or, the signaling may be disabled.

The module may be configured for E&M Type I, II, or III signaling, or a proprietary (VF-6 compatible) format. The unit may be configured in four transmit modes: continuous transmit, hook switch activated, voice activate (VOX), or, receive only. The calibrated extended-range audio input and output level adjustments make it easy to integrate into any system.

There are two I/O module adapters available that include the following:

MA-301A-1	One-channel 4W Term Block I/O
MA-301B	Screw Compression I/O

VF-8A Selective Calling Module

The RFL VF-8A Selective Calling Unit is a two-wire selective calling order wire module designed for use in the RFL 9508 and IMUX 2000 T1/E1 multiplexer. The VF-8A provides a very reliable means of voice communications between multiple locations using a single DSO time slot. It accepts a single voice channel as input, and converts it into a 64kbps signal that can be transmitted over the RFL-9508 and the IMUX 2000 T1/E1 when interfaced via an electrical or optical interface.

The VF-8A allows the use of standard Dual-Tone Multi-Frequency (DTMF) telephones to selectively place a call between any or all locations within the RFL orderwire network. The three levels DTMF signaling include "Unique", "Group", and "All" call. Call progress tones are provided to indicated phone ringing, circuit busy, circuit available, and phone out-of-service. These give the VF-8A the "feel" of a real telephone instead of a party line. Three busy circuit modes are available. The level of privacy that the local extension maintains depends on the setting of each remote extension. A "time-out" feature is included to free up the network for other calls if a phone is inadvertently left in the off-hook condition for a period exceeding 50 seconds.

All of the VF-8A settings can be configured via local switches or remotely with the use of NMS.

The VF-8A uses the MA-306 module adapter.

VF-15C-1 Dual Channel 2-Wire Foreign Exchange Office End (FXO) Module

The VF-15C-1 is a voice frequency module used to connect a standard 2-wire telephone line from a central office or PBX to the RFL-9508 or IMUX 2000 T1/E1 multiplexer. The module may be used in conjunction with the RFL VF-16B-1 (FXS) Module to provide an off premise extension. The module may be configured to use one or both of the available channels. Each enabled channel utilizes one 64 Kbps time slot. The module uses the MA-303 module adapter, which provides two RJ-11 jacks (with input protection circuits and bantam jacks for testing).

Analog and Digital Interfaces (continued)

The RFL 9508 has many interfaces that are also used with the RFL IMUX 2000 family of T1/E1 multiplexers. The following interfaces are available:

Analog Interface Modules:

VF-5XP Voice Module

This module provides either one or two voice grade channels, with high quality voice characteristics and extended range input/output level adjustments. The VF-5XP uses Pulse Code Modulation (PCM) coding with each voice channel occupying from 1 to 3 64 kbps* time slots for transmission over the powerline by the PLC transceiver in the RFL 9508. Jumpers on the module allow the user to select E&M Type I, II, III, and V signaling, with front panel status indicators and front panel bantam jacks to provide test access.

There are a variety of I/O module adapters available that include the following:

MA-301A Surge Isolated 4W Terminal Block I/O

MA-301B Screw Compression I/O

The module can be configured as follows:

Two Channels of 300 Hz - 2,200 Hz (or 300Hz - 3,400Hz) Voice Grade Channels. If the PLC application is only a single channel system, the second channel will not be available.

One Channel of Speech and Speech-Plus, the audio range of each is programmable to suit the application need.

*1 - 64 kbs time slot for a 300 Hz - 2,200 Hz (or 300-3,400 Hz) voice channel or 3 - 64 kbs time slots if the channel is to be divided into a Speech and Speech-Plus channel.

VF-6I Single Channel Four-Wire Order Wire Module

The RFL VF-6I Orderwire Module provides multi-drop (party line) communications link between facilities using a single time slot. The module may be used in a RFL 9508 when it is configured as an end terminal, or as a drop and insert terminal connected electrically or optically to an IMUX 2000 T1/E1 multiplexer. The unit uses m-Law companding and may be configured to transmit in either or both bus directions. The signaling is either CAS (E1) or RBS (T1), or, the signaling may be disabled.

The module may be configured for E&M Type I, II, or III signaling, or a proprietary (VF-6 compatible) format. The unit may be configured in four transmit modes: continuous transmit, hook switch activated, voice activate (VOX), or, receive only. The calibrated extended-range audio input and output level adjustments make it easy to integrate into any system.

There are two I/O module adapters available that include the following:

MA-301A-1 One-channel 4W Term Block I/O

MA-301B Screw Compression I/O

VF-8A Selective Calling Module

The RFL VF-8A Selective Calling Unit is a two-wire selective calling order wire module designed for use in the RFL 9508 and IMUX 2000 T1/E1 multiplexer. The VF-8A provides a very reliable means of voice communications between multiple locations using a single DS0 time slot. It accepts a single voice channel as input, and converts it into a 64kbps signal that can be transmitted over the RFL-9508 and the IMUX 2000 T1/E1 when interfaced via an electrical or optical interface.

The VF-8A allows the use of standard Dual-Tone Multi-Frequency (DTMF) telephones to selectively place a call between any or all locations within the RFL orderwire network. The three levels DTMF signaling include "Unique", "Group", and "All" call. Call progress tones are provided to indicated phone ringing, circuit busy, circuit available, and phone out-of-service. These give the VF-8A the "feel" of a real telephone instead of a party line. Three busy circuit modes are available. The level of privacy that the local extension maintains depends on the setting of each remote extension. A "time-out" feature is included to free up the network for other calls if a phone is inadvertently left in the off-hook condition for a period exceeding 50 seconds.

All of the VF-8A settings can be configured via local switches or remotely with the use of NMS.

The VF-8A uses the MA-306 module adapter.

VF-15C-1 Dual Channel 2-Wire Foreign Exchange Office End (FXO) Module

The VF-15C-1 is a voice frequency module used to connect a standard 2-wire telephone line from a central office or PBX to the RFL-9508 or IMUX 2000 T1/E1 multiplexer. The module may be used in conjunction with the RFL VF-16B-1 (FXS) Module to provide an off premise extension. The module may be configured to use one or both of the available channels. Each enabled channel utilizes one 64 Kbps time slot. The module uses the MA-303 module adapter, which provides two RJ-11 jacks (with input protection circuits and bantam jacks for testing).

VF-16B-1 Dual Channel 2-Wire Foreign Exchange Station End (FXS) Module

The VF-16-1 is a voice frequency module used to connect a standard 2-wire telephone to the RFL 9508 or IMUX 2000 T1/E1 multiplexer. The module may be used in conjunction with the RFL VF-15C-1 (FXO) Module to provide an off premise extension. Two VF-16B-1s may be used with Automatic Ring Down (ARD) to provide a direct node-to-node telephone link without requiring a PBX or Key system. The module may be configured to use one or both of the available channels. Each enabled channel utilizes a 64 Kbps time slot.

The module uses the MA-303 module adapter. The MA-303 provides two RJ-11 jacks (with input protection circuits and bantam jacks for testing).

Interfaces and Teleprotection

RFL 9850 Programmable FSK Tone Modules

The RFL 9850 TX/RX contains transmitter and receiver sections fully independent of each other. They can be individually programmed for any center frequency from 300 to 3200Hz, with frequency shifts up to 300Hz and at speeds up to 600 Baud (2F operation only).

RFL 9840 TMX/TMR Programmable Telemetry Transmitter and Receiver

Each module contains the features of a programmable FSK tone channel with a programmable telemetry channel to produce a low-cost telemetry system of unequalled versatility, flexibility, and accuracy. The RFL 98 TMX Programmable Telemetry Transmitter has a wide input span; it can be programmed to accept telemetry inputs as small as 100mV or as large as 10 volts. Its output level can be set anywhere from -40dBm to 0 dBm, in 0.25dBm increments. It can set to produce fixed levels for test purposes (0, 10, 50, 90, or 100 percent of full scale).

DIGITAL Interface Modules:

MA-490 Diagnostic Ethernet Interface

The RFL MA-490, is an RS232/Telnet I/O adapter module used in RFL 9508 for Telnet link capability. This module contains one Ethernet port and two RS-232 ports. The basic function of this module is to provide connectivity to the RFL 9508 via an Ethernet network.

User Interface

Man Machine Interface

A Windows® (W95, W98, ME, W2000, NT and XP) program allows the user to configure all RFL 9508 parameters; the channel mapping for the SSB/E1/T1, load the carrier frequency to the NCO, adjust output power level, as well as to measure the SNR, alarms, etc. See figure 7 for typical setup screen.

Slow speed communication with remote terminal via FSK modulation of guard tone

The system is able to project its serial user interface to the far end of the link using the guard or pilot tone as a narrow band FSK modem to provide a 75 Baud link.



Figure 7. Typical Setup Screen

Both the IMUX and Transceiver user interfaces can be remotely accessed by this link.

RFL 9508 Integrated or RFL 9508 RT External Teleprotection

Overview

The RFL 9508 is available with either integrated teleprotection or with an external distant teleprotection system known as RFL-9508 RT. Both systems use a four function plug-in Modular Transfer Trip System (PLC-TT) based on the proven F6 protection scheme.

The system is suitable for Direct Transfer Trip (DTT), Permissive Transfer Trip (PTT), Blocking and Unblocking applications. RFL 9508 and RFL 9508 RT comply to the IEC60834-1 teleprotection standard.

The PLC-TT system is comprised of two parts, the PLC-TT module and the I/O modules. Together these modules work with the balance of the RFL 9508 system to provide four-function teleprotection. Up to two MTS modules can be used in each system to provide up to eight functions of teleprotection.

The PLC-TT module senses the inputs, de-bounces them, applies a small amount of logic, and passes them in a timeslot on the E1/T1 link to the transceiver. The PLC-TT limits commands to 2 seconds, returning to the guard states after that time, even if the inputs remain keyed. The PLC-TT user interface is in the IMUX NMS. Two and four function relay and solid-state I/O's are available. Additional I/O for providing parallel contacts is also supported.

The PLC transceiver DSP decodes the message from the PLC-TT and creates the necessary tones to transfer the command to the other end. The other end receives the tones, performs the necessary actions to generate the needed security and dependability, and sends the information to the PLC-TT via the E1/T1 link.

Interfaces and Teleprotection (continued)

RFL 9508 RT Distant Teleprotection via Optic Link

Many times the protective relays are not located in the same building as the communications systems that are used to transmit the relaying signals. A unique feature of the RFL 9508 is that the teleprotection modules can be housed in a separate chassis and communicate with the RFL 9508 via fiber optic cable. The teleprotection chassis can be located up to 113km (70 miles) from the RFL 9508 depending on the type of fiber optic transceiver selected. This chassis is known as the RFL 9508 RT. (See Figure 8)

General Specification

F6 teleprotection is a single tone system that sends only one tone at a time, making it ideal for PLC. Different combinations of inputs use a priority scheme to generate the correct tone and the correct output on the receiving side. This system can have two, four or eight inputs and outputs, which are programmable. Each input can be optionally inverted or not and if 8 inputs are employed, paired inputs can be AND'ed or OR'ed to form each of the 4 command inputs.

Once the input commands have been determined, the transmitted command is determined according to the priority chart. Two charts are available, based on the mode setting, "2+2" which provides four commands with priority or "3+1" which provides three independent and simultaneous commands. The 2+2 mode is typically used for parallel line applications, while the 3+1 mode is typically used for single pole trip applications (See Figures 9 and 10.) The transmitted command is sent to the PLC transceiver after an appropriate de-bounce period.

Depending on the mode and the command, the transceiver sends one frequency for the entire time or switches back and forth between two frequencies. The single frequency is considered un-coded operation. Un-coded is less secure and is used for permissive or blocking applications. Coded transmission consists of two frequencies sent one after the other for a specified time. The receiver must receive each tone for a specified time period before declaring a valid trip reception.

Once the receiving DSP has determined that a valid trip has been received, the RX trip command is sent to the PLC-TT where it is decoded into output contacts according to a user setup similar to that for the inputs.

Additional Features:

Selectable Unblock Logic

In the event that the receiver enters an alarm state, the outputs programmed for unblocking will go active after 20 ms and will remain active for 150 ms.

Integrated SOE

The PLC-TT stores up to 100 events including; Time/Date, and Input/Output contact status.

Trip Counters

Trip counters record how many times each command is sent or received. The counters roll over after 255 counts.

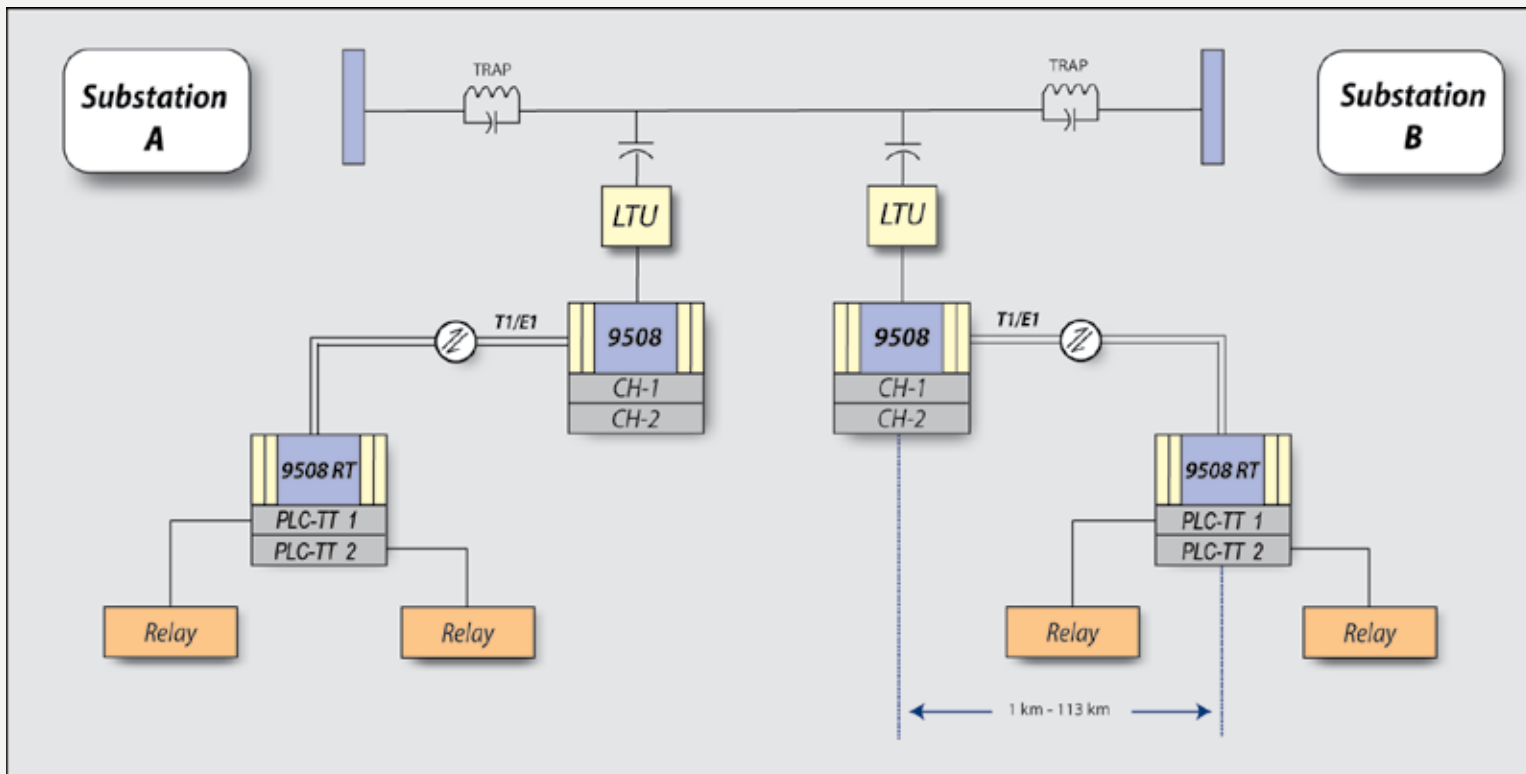


Figure 8. Distant Teleprotection via Optic Link

Features and Specifications

Integrated Test Switch

The PLC-TT module supports the connection of an internal test panel. The test panel can be mounted inside the door of the chassis and connect to the PLC-TT via an 8 wire cable. The test panel has a 10 position rotary switch, a push-button, and two-toggle switches. The rotary switch has Normal, Input #1, Input #2, Input #3, and Input #4 positions. The test switch can accommodate 2 PLC-TT cards. Selecting input 1 through 4 positions will not do anything until the push-button is pressed. Pressing the push-button will send the command corresponding to the selected position. The toggle switch disables the local outputs. The RFL 9508 can accommodate 2 PLC-TT units.

Teleprotection Electrical Specifications

Optically Isolated Inputs:

Operating Voltage Range:	
48 Vdc	38-60 Vdc
125 Vdc	88-150 Vdc
250 Vdc	200-280 Vdc
Input threshold 1/2 normal station battery.	

Solid-State Outputs:

Maximum continuous output current	1 A
Minimum output current	20 mA
Maximum open circuit voltage	280 Vdc
Maximum turn on delay	100 Qs

Optional Relay Outputs:

Maximum continuous output current	2 A (inductive)
Maximum surge current (100ms)	30 A
Maximum breaking current	1 A (resistive)
Maximum open circuit voltage	280Vdc
Maximum operate time	5 ms
ESD Withstand	IEC-610004-2, ANSI C37.90.3
RFI Withstand	IEC-60834, ANSI C37.90.2
SWC Withstand	IEC-801-4, ANSI C37.90.1
Dielectric Withstand	2500 Vdc per IEC-60255-22-1 and IEC-60834-1

Alarm Relay

Output Form	"C" (spdt)
Open Circuit Voltage	300 Vdc
Current (continuous)	1 A
Breaking Current	1 A, Non-inductive

Technical Specifications

RF Band

Frequency range	20 to 500 kHz
Full duplex Channels	1, 2, 3, or 4 SSB Channels
Channel Bandwidth	2.5 kHz, 4 kHz
Selectivity	
Overall (4 kHz from Bandedge)	<= -75 dBmO
Channel (0.3 kHz from Bandedge)	<= -65 dBmO
Impedance	50, 75, 100 or 150 Ohms unbalanced or balanced

AF Band

AGC dynamic range	+14 to -26 dB, or + 20dB
Background Noise	<= -55 dBmOp (IEC60495 recomment)
Harmonic Distortion	<= -40 dBmO F=400 Hz (IEC 495 recomment)
Group Delay	(IEC60495 recomment)
Frequency Stability	± 0.5 Hz at 250 kHz (±2 ppm)
Tx Line Filters	Adjustable from 20 to 500 kHz
Rx Line Filters	Adjustable from 20 to 500 kHz
Minimum sensitivity	-30 dBm

Signaling (Pilot)

Frequency	3825 Hz, 3600 or 2385
Type of modulation	FSK
Frequency shift	± 30 Hz from channel center frequency

Environmental Conditions

Ambient Temperature Range	-20 to + 65°C
Relative Humidity	0 to 95% non condensing

Weight

50W RFL 9508	38 lbs / 17.3 kg
100W RFL 9508	54 lbs / 24.6 kg

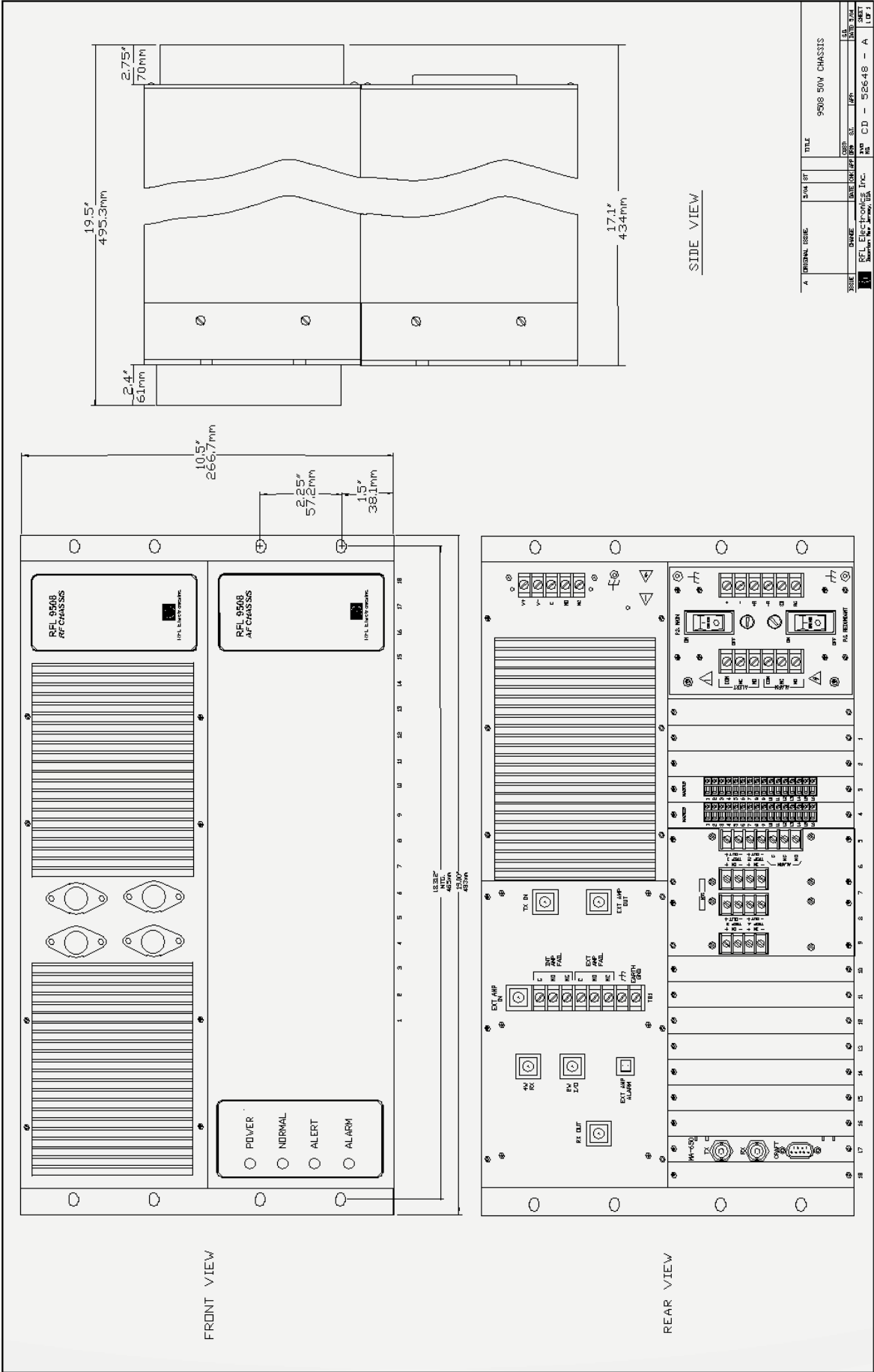
<i>Input Command</i>	<i>TX Command (actual TX)</i>	<i>Frequency (2 / coded)</i>	<i>Receiver outputs</i>
No input	None	Pilot	None
A	A	F3	A
B	B	F5	B
A&B	A&B	F7	A&B
C	C	F2,F4	C
D	D	F2,F6	D
C&D	C&D	F4,F6	C&D
A&D	A&D	F6,F8	A&D
B&C	B&C	F4,F8	B&C
A&C	C	F2,F4	C
B&D	D	F2,F6	D
A&B&C	B&C	F4,F8	B&C
A&B&D	A&D	F6,F8	A&D
A&C&D	C&D	F4,F6	C&D
B&C&D	C&D	F4,F6	C&D
A&B&C&D	C&D	F4,F6	C&D

Figure 9. Command Priority Table for "2+2" Mode

<i>Input Command</i>	<i>TX Command (actual TX)</i>	<i>Frequency (2 / coded)</i>	<i>Receiver outputs</i>
No input	None	Pilot	None
A	A	F3	A
B	B	F5	B
A&B	D	F7	A&B
C	C	F2	C
B&C	D	F4	B&C
A&C	D	F1	A&C
A&B&C	D	F6	A&B&C

Figure 10. Command Priority Table for "3+1" Mode

Technical Diagrams (continued)



Ordering Information

RFL 9508 PLC Ordering Information		
RFL Part Number (fill in blanks):		9508
Base System		
Chassis		
Power Supply		
38-150 Vdc	A	
200-300 Vdc	B	
RF Power Options		
50W	0	
100W	1	
Integral Teleprotection Modules		
None	0	
One	1	
Two	2	
Teleprotection I/O (Select 2)		
None or External (if External choose Drop and Insert Mode)	0	
PLC-TT w/2 function Solid State 48/125 Vdc	1	
PLC-TT w/2 function Solid State 250 Vdc	2	
PLC-TT w/4 function Solid State 48/125 Vdc	3	
PLC-TT w/4 function Solid State 250 Vdc	4	
PLC-TT w/2 function Relay 48/125 Vdc	5	
PLC-TT w/2 function Relay 250 Vdc	6	
PLC-TT w/4 function Relay 48/125 Vdc	7	
PLC-TT w/4 function Relay 250 Vdc	8	
Drop and Insert Mode		
None	0	
Electrical T1/E1 (MA-278)	A	
Electrical E1 75 ohm (MA-271)	B	
Fiber 820 nm Multimode	C	
Fiber 1300 nm LED singlemode	D	
Fiber 1300 nm Laser singlemode	E	
Fiber 1550 nm Laser singlemode	F	
PLC Audio Options (Select 2) Note: If orderwire is required a VF-5XP must be selected.		
None	0	
Speech Plus with comp. blocks(VF-5XP, MA-301B)	A	
Speech Plus with screw terminals (VF-5XP, MA-301A)	B	
Speech with comp. blocks (VF-5C, MA-301B)	C	
Speech with 50 Pin telco (VF-5C, MA-301)	D	
Speech with screw terminals (VF-5C, MA-301A)	E	
FXO with Modular Jacks (VF-15C-1, MA-303)	F	
FXS with Modular Jacks (VF-16B-1, MA-303)	G	
Orderwire with comp. blocks (VF-6I, MA-301B)	H	
Orderwire with screw terminals (VF-6I, MA-301A-1)	J	
Selective Calling Module (VF-8A, MA-306)	K	
Special Options		
None	0	
Special Configuration	X	
Ethernet remote access (MA-490)	1	

Ordering Information (continued)

RFL 9508 Remote Trip Chassis PLC Ordering Information

RFL Part Number (fill in blanks):		9508RT									
Base System											
Chassis											
Power Supply											
38-150 Vdc											A
200-300 Vdc											B
Remote Teleprotection Modules											
One											1
Two											2
Teleprotection I/O (Select 2)											
None											0
PLC-TT w/2 function Solid State 48/125 Vdc											1
PLC-TT w/2 function Solid State 250 Vdc											2
PLC-TT w/4 function Solid State 48/125 Vdc											3
PLC-TT w/4 function Solid State 250 Vdc											4
PLC-TT w/2 function Relay 48/125 Vdc											5
PLC-TT w/2 function Relay 250 Vdc											6
PLC-TT w/4 function Relay 48/125 Vdc											7
PLC-TT w/4 function Relay 250 Vdc											8
Remote Interface											
Electrical T1/E1 (MA-278)											A
Electrical E1 75 ohm (MA-271)											B
Fiber 820 nm Multimode											C
Fiber 1300 nm LED singlemode											D
Fiber 1300 nm Laser singlemode											E
Fiber 1550 nm Laser singlemode											F
PLC Audio Options (Select 2) Note: If orderwire is required a VF-5XP must be selected.											
None											0
Speech Plus with comp. blocks(VF-5XP, MA-301B)											A
Speech Plus with screw terminals (VF-5XP, MA-301A)											B
Speech with comp. blocks (VF-5C, MA-301B)											C
Speech with 50 Pin telco (VF-5C, MA-301)											D
Speech with screw terminals (VF-5C, MA-301A)											E
FXO with Modular Jacks (VF-15C-1, MA-303)											F
FXS with Modular Jacks (VF-16B-1, MA-303)											G
Orderwire with comp. blocks (VF-6I, MA-301B)											H
Orderwire with screw terminals (VF-6I, MA-301A-1)											J
Selective Calling Module (VF-8A, MA-306)											K
Special Options											
None											0
Special Configuration											X
Ethernet remote access (MA-490)											1



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