Phoenix Digital

GE FANUC GENIUS™ AND SNP OPTICAL COMMUNICATION MODULES

INSTALLATION and USERS MANUAL

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PHOENIX DIGITAL CORPORATION

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User's Manual

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CHAPTER 1

DESCRIPTION AND SPECIFICATION

1.1 INTRODUCTION

Phoenix Digital's family of GE Fanuc Genius and Series 90™ Protocol (SNP) Optical Communication Modules (OCM) provide the most advanced, comprehensive, state-of-the-art fiber optic communication capabilities on the market today. Phoenix Digital's OCM modules translate the Genius and SNP electrical interfaces into an optical network medium, transparent to the communication protocol and configurable for distribution by the user in ring, bus, star, or point-to-point network installations. Fiber optic network options include features not found in even the most expensive communication network installations; on-line diagnostic monitoring with high speed self healing communication recovery around points of failure (Fault Tolerant), in-line signal strength monitoring with annunciation of impending communication failures (Fault Predictive), and wavelength selection for matching fiber media characteristics to enable communication over extended distances. Phoenix Digital makes all of this possible through application of its patented self healing communication switch and advanced optical measurement technologies.

The following table provides correspondence between OCM Model # and GE Fanuc network compatibility. The user should check the OCM Model # label located on the component side of the Plug-in OCM module, or on the side of the Standalone OCM enclosure, in order to verify network interface compatibility.

OCM Model #	GE Fanuc Network Compatibility
OCM-GEN-xx(1)-(2)-(3)-(4)-(5)-(6)	Genius Communications
OCM-SNP-xx(1)-(2)-(3)-(4)-(5)-(6)	Series 90 Protocol Communications
OCM-CBL-SNY(7)	OCM-SNP Interconnect Cable for Series 90 PLCs
OCM-CBL-WSY(7)-(8)	OCM-SNP Interconnect Cable for Workmasters™

(1) "xx" = 85 for 850 nanometer wavelength selection
= 13 for 1300 nanometer wavelength selection (extended distance)
(2) "P" = Panelmount OCM Module (with enclosure)
blank = Series 90/70 Plug-in OCM Module
(3) "D" = Fault Diagnostic Outputs
blank = No Fault Diagnostic Outputs
(4) "ST" = ST Fiber Optic Connector Style
"SMA" = SMA Fiber Optic Connector Style
(5) "ACV" = 110/220VAC, 50/60Hz Operation
"24V" = 24VDC Operation
(6) "SM" = Singlemode Operation (Available with 1300 Nanometer and ST Connector Options Only)
blank = Multimode Operation
(7) "Y" = 2 for two foot length
= 9 for nine foot length
(8) "MC" = Direct Connection to WSI-less Miniconverter
blank = Direction Connection to WSI Module

A summary of selected OCM features is given below:

- o Supports a Wide Range of Communication Distances (up to and beyond 16 miles/25 kilometers between nodes)
- o Fault Tolerant Communication: Provides On-line Diagnostic Monitoring and High Speed, Self Healing Communication Recovery
- o Fault Predictive Communication: Provides In-line Optical Signal Strength Monitoring and Annunciation of Impending Communication Failures
- o Fault Diagnostics: Locates Fault and Impending Fault Conditions
- o Selectable Wavelengths: 850 nanometers, 1300 nanometers

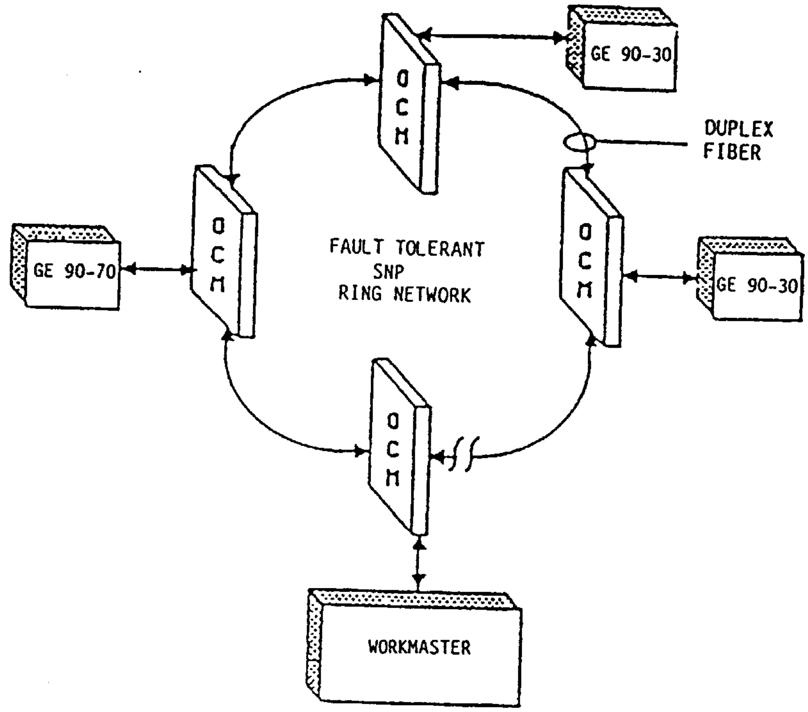
- o Singlemode or Multimode Operation
- o Easy to see, visual indication of Communication Diagnostic Status

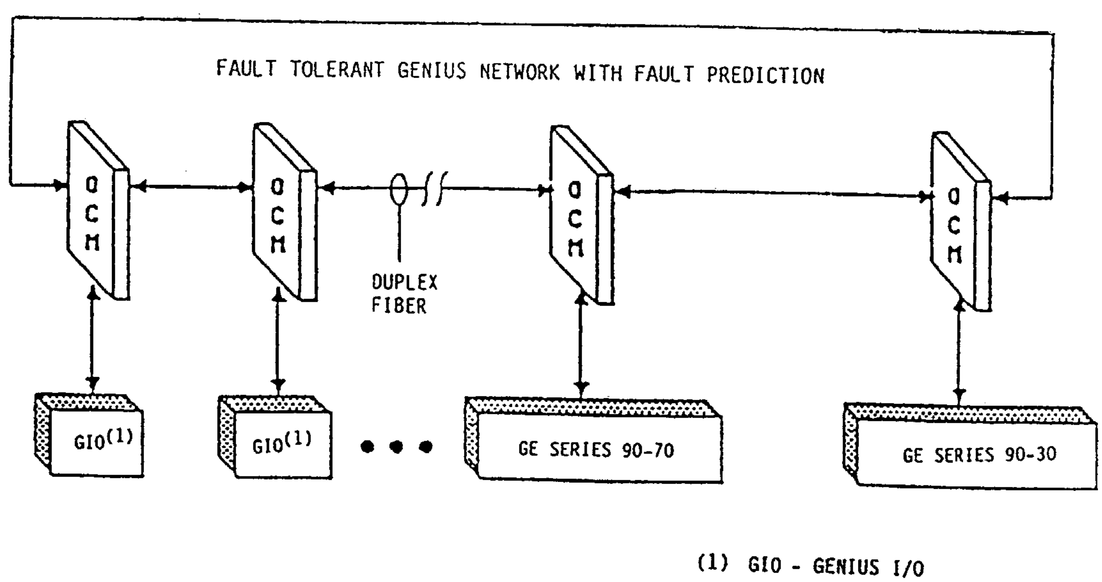
1.2 PRODUCT DESCRIPTION

1.2.1 FAULT TOLERANT, SELF HEALING COMMUNICATION

Phoenix Digital's Fault Tolerant, Self Healing Communication technology provides diagnostic monitoring of the communication signal waveforms at each node on the network, and ultra-high speed detection, isolation, and correction of points of communication failure anywhere on the network grid. OCM modules will self heal around communication failures in ring, bus, star, or point-to-point network configurations. Figure 1 illustrates Examples of Typical OCM Network Configurations.

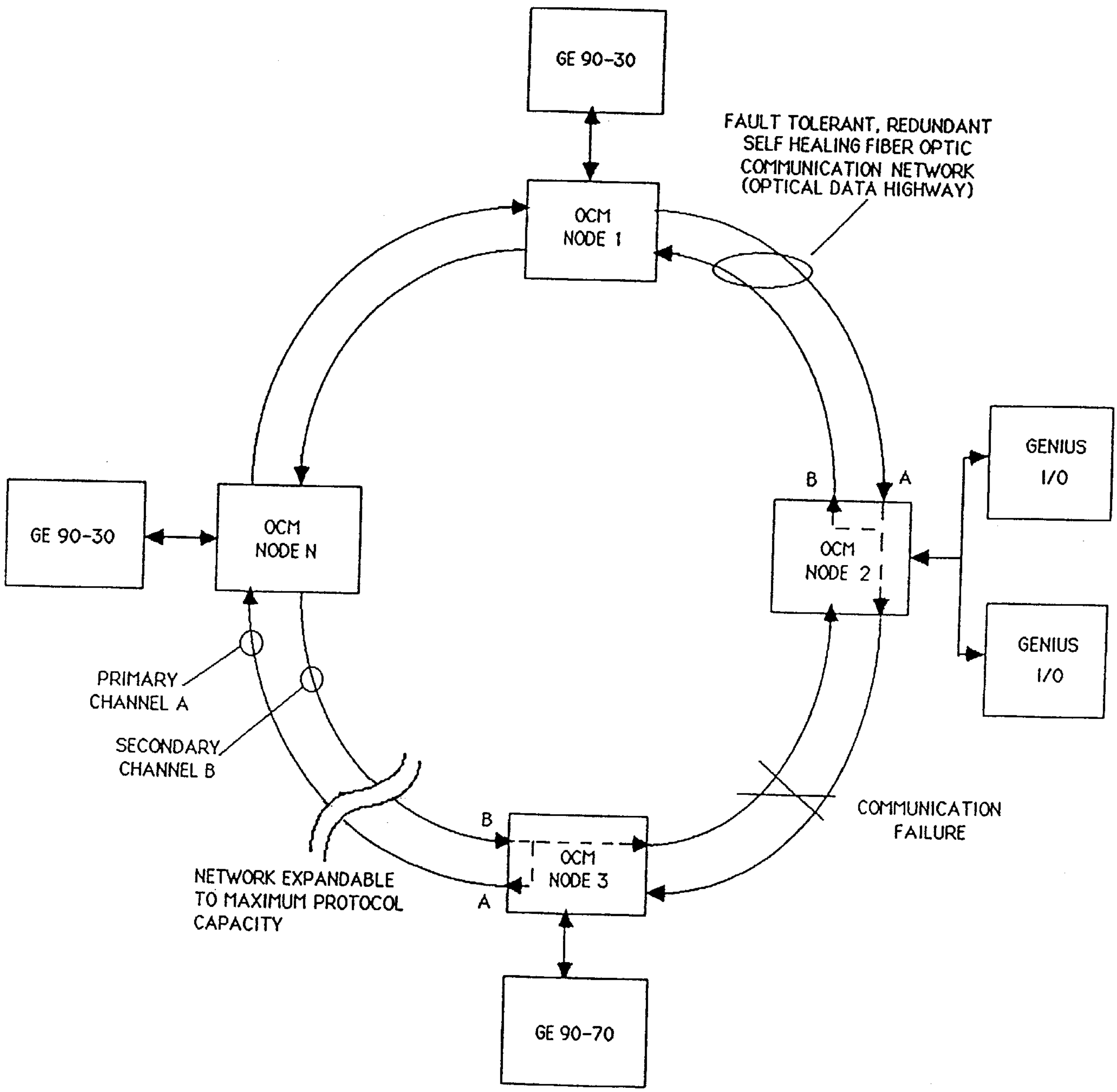
The ultra-high speed, self healing communication technology on each OCM module will automatically redirect network traffic around points of failure (wrapback communication). In a failed condition the OCM communication network will self heal around a fault by redirecting data communications around the point of failure. This is accomplished by wrapping back network communications at the communication nodes on either side of the point of failure, through the use of a high-speed, combinational wrapback communication switch (hardware pass-thru, non-software interactive) built into the front-end optical interface of each OCM communication module. An example of how an OCM network provides self healing communication wrapback is illustrated in Figure 2. Diagnostic monitoring circuitry at each node will continuously monitor the integrity of the communication carriers present at the receive inputs of each communication channel. This high speed combinational diagnostic monitoring circuitry will monitor and detect communication failures in carrier symmetry, jitter, amplitude, and babble. In the event a fault condition is diagnosed on the primary communication channel receive input (Node 3/Channel A) the high speed, self-healing communication switch will immediately redirect communication by retransmitting data received from the secondary receive input (Node 3/Channel B) on both the primary and secondary transmit outputs. Analogously, when a fault is detected on the secondary communication channel receive input (Node 2/Channel B) the self-healing communication switch will redirect communication by retransmitting data received from the primary receive input (Node 2/Channel A) on both transmit outputs. The fault condition simulated between nodes 2 and 3 is effectively isolated on one side by node 2 which redirects channel A data back via channel B, and on the other side by node 3 which redirects channel B data back via channel A. Essentially the network dynamically reconfigures to form a new ring from node 2 to node 3, away from the point of failure (the long way around the network), thus insuring communication network continuity and fault isolation. In addition to providing network fault tolerance, OCM modules enable maintenance personnel to locate fault conditions (remote status monitoring), add/delete nodes, and splice/terminate/replace media on-line, without disrupting network communications.





EXAMPLES OF TYPICAL OCM NETWORK CONFIGURATIONS

FIGURE 1



OCM NETWORK ILLUSTRATING SELF HEALING COMMUNICATION WRAPBACK

FIGURE 2

Communication continuity will be unconditionally maintained by OCM modules in the event of either node or media failure. When the source of the network failure is corrected, OCM modules will automatically restore the communication network to its' original traffic patterns. Genius and SNP networks may be implemented in any combination of hardwire multi-drop and fiber optic daisy-chain network configurations.

1.2.2 FAULT PREDICTIVE COMMUNICATION

Phoenix Digital's Fault Predictive Communication Technology provides diagnostic monitoring and detection of impending communication failures resulting from gradual degradation of the communication link itself. The OCM module monitors impending fault conditions by continuously measuring the actual in-line signal strength (optical power) of the data communications at each receive input on the module. The OCM module continuously compares these actual in-line measurements to preset optical power reference thresholds, which are normalized to power levels where valid network communications will still be assured but impending communication failures can be accurately predicted. If the actual in-line data communication signal strength degrades below these power thresholds (resulting from one or more sources of link degradation) the OCM module will automatically detect and annunciate the impending failure condition via visual indicators on the front of the module. The OCM also provides hardwired diagnostic outputs for remote monitoring, detecting, and locating impending fault conditions (remote status monitoring). In addition the OCM module provides a linear DC voltage representation (analog) of the actual in-line signal strength (normalized for a 0 to +10 volt range) for more precise monitoring of communication link status (gradient analysis, intelligent diagnostic monitoring, etc.). Thus, communication link status is continuously monitored and impending failure conditions are annunciated by the OCM module before the communication failure actually occurs, enabling maintenance personnel to perform Predictive Maintenance on the fiber optic communication network at-large. (The Impending Fault Monitoring Feature is available only on multimode fiber optic modules with the "-D" Diagnostic Option.)

1.2.3 WAVELENGTH SELECTION FOR LONG DISTANCE COMMUNICATION

The OCM module provides three options for wavelength selection. The economical 850 nanometer wavelength may be selected for data communication networks with less than two miles (3.3 kilometers) between communication nodes. The higher performance 1300 nanometer multimode wavelength may be selected for longer distance applications, extending communication distances between nodes to over 6 miles (10 kilometers). For maximum distance, the ultra-high performance 1300 nanometer singlemode wavelength may be selected, extending communication distances to over 16 miles (25 kilometers) between communication nodes!

1.3 PRODUCT SPECIFICATIONS

1.3.1 DEVICE INTERFACE SPECIFICATIONS

OCM Device Interface Port connections are provided on the front of the OCM module (designated as J1 - see Figure 3 for Plug-In OCM, see Figure 4 for Standalone, Panelmount OCM). Specifications detailing the OCM device interface port pin-out is given below:

J1 Connector Pin Numbers(1)	GENIUS Signal Name
1	Serial 1(2,3)
2	Serial 2(2,3)
3	Shield Out
4	N/C
5	N/C
6	Serial 1(2,3)
7	Serial 2(2,3)
8	Shield In

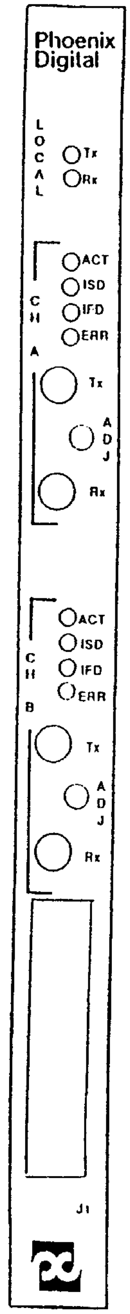
OCM-GEN DEVICE INTERFACE PIN DEFINITIONS

TABLE 1(A)

(1) Orientation - Top to bottom on front of module (Pins 1 thru 8 respectively).

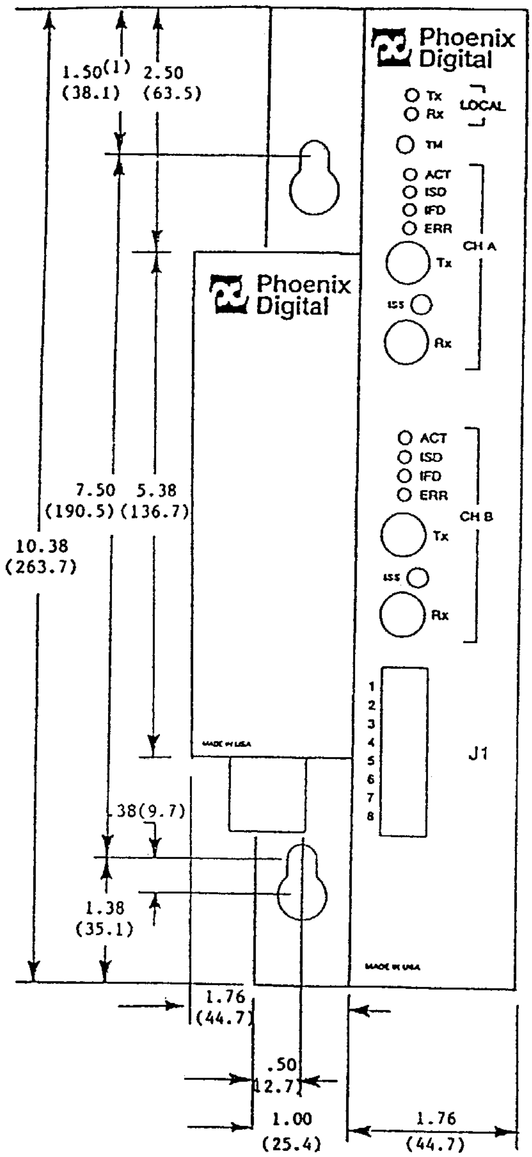
(2) Each end of the electrical Genius Bus must be terminated with a resistor. If the OCM is located on either end of the bus then this resistor must be connected across Serial 1 and Serial 2 on the OCM barrier strip. If it is not on the end of the electrical bus then the OCM should not be terminated (see Section 1.3.4 for example of terminated installation). A 150 ohm resistor is supplied with each OCM. However, the correct value for the termination resistor depends upon the electrical characteristics of the hardwired Genius network cable used. Consult GE Fanuc Genius Network Installation Guidelines for more information.

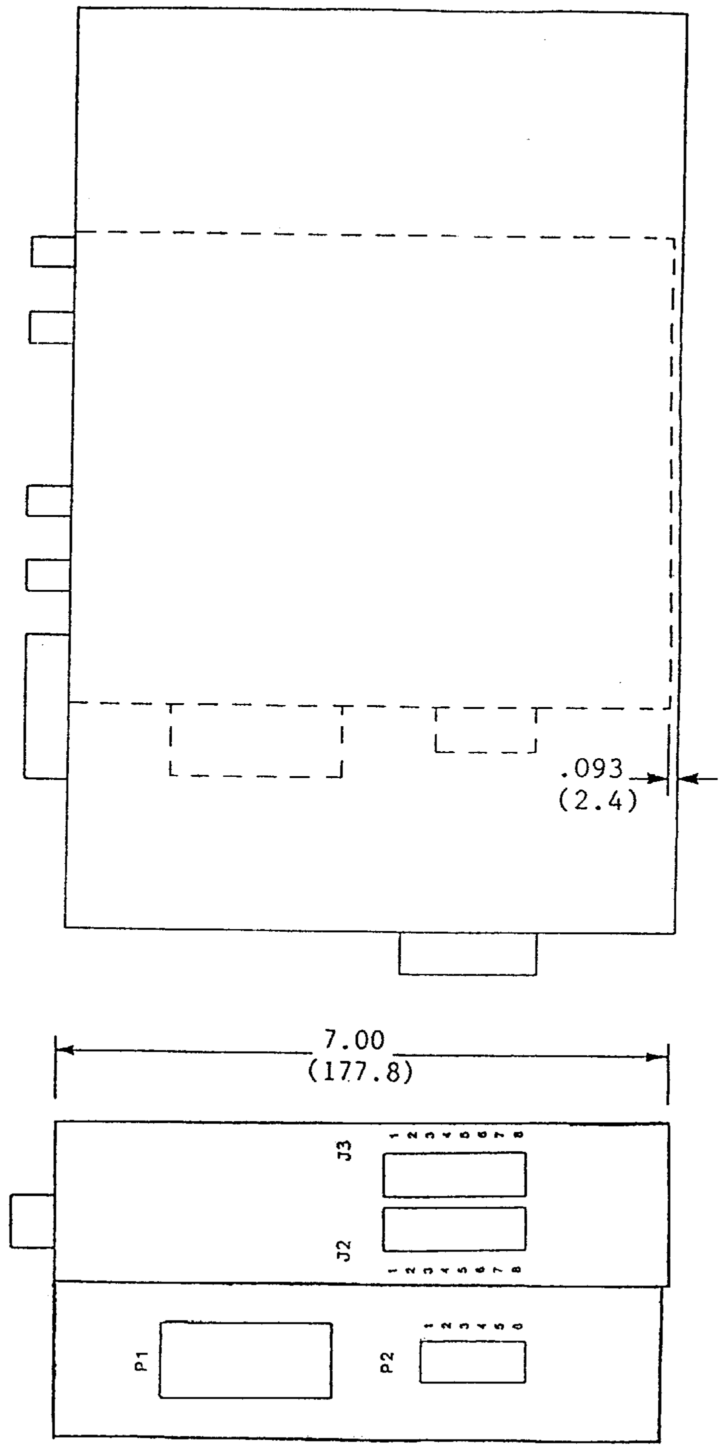
(3) All Genius devices on the hardwired Genius bus must be interconnected Serial 1 to Serial 1, Serial 2 to Serial 2. Cross-connecting Serial 1 and Serial 2 will cause communication failures.



GE FANUC GENIUS, SNP
OCM FACEPLATE DESIGNATIONS

FIGURE 3





(1) ALL DIMENSIONS SHOWN IN INCHES (MILLIMETERS) ± 2%

GE FANUC GENIUS, SNP STANDALONE
OCM MOUNTING SPECIFICATION

FIGURE 4

OCM J1 Connector Pin Numbers(1)	Series 90-70, 90-30 SNP Connector Pin Numbers(2)	Workmaster WSI Module Connector Pin Numbers(3)	Workmaster WSI-less Miniconverter Pin Numbers(4)	SNP Signal Name(5)
1	1	37	1	Shield
2	13	26	11	SD(B) - Send Data
21	12	27	10	SD(A) - Send Data
3	11	34	13	RD(B') - Receive Data
25	10	35	12	RD(A') - Receive Data
4	14	32	8	RTS(B) - Request to Send
9	6	33	15	RTS(A) - Request to Send
8	8	30	14	CTS(B') - Clear to Send
23	15	31	6	CTS(A') - Clear to Send
7	7	1	7	SG (Signal Ground)
12	-	-	-	RT (Resistor Termination)
-	9	-	-	RT (Resistor Termination)
-	-	36	-	RT (Resistor Termination)
-	-	-	9	RT (Resistor Termination)
6	-	-	5	+5 VDC Power Supply for Miniconnector

OCM-SNP DEVICE INTERFACE PIN DEFINITIONS

TABLE 1(B)

(1) OCM-SNP connector J1 is a 25 pin D-subminiature (female pins). All undesignated pin numbers should remain unconnected to any external electrical signals. Pin #12 is used for line termination. When pin #12 is jumpered to pin #21 a 100 ohm termination resistor is applied across the Send Data outputs (inputs to the OCM). Pin #12 is jumpered to pin #21 in <u>all</u> Phoenix Digital point-to-point communication cables.

(2) Series 90-70 and 90-30 SNP Connectors are 15 pin D-subminiature (female pins). Pin #9 is used for line termination and is jumpered to Pin #10 in Phoenix Digital's OCM-CBL-SNY point-to-point communication cables. For GE Fanuc Series 90 PLC Model #s IC697CPU731 and IC697CPU771 these cables must be modified to remove the jumper between pins 9 and 10 and install a jumper between pins 9 and 11.

(3) Workmaster SNP connectors on WSI modules are 37 pin D-subminiature (female pins). Pin #36 is used for line termination and is jumpered to Pin #34 in Phoenix Digital's OCM-CBL-WSY point-to-point communication cables.

(4) Workmaster SNP connectors on WSI-less Miniconverters are 15 pin D-subminiature (female pins). Pin #9 is used for line termination and is jumpered to Pin #10 in Phoenix Digital OCM-CBL-WSY-MC point-to-point communication cables.

(5) SNP Signal Name Convention (for Series 90 PLCs and Workmasters) -
   - o (A) and (B) are equivalent to - and +
   - o A' and B' denote inputs for Workmaster, outputs for Series 90 PLCs and OCM-SNPs

OCM model number OCM-GEN provides fiber optic Genius communications. It operates at the maximum Genius communication baud rate of 153.6K baud EXT (Extended Genius). (All Genius devices connected to Phoenix Digital OCMs should be configured for this baud rate.) OCM model number OCM-SNP provides fiber optic Series 90 Protocol communications. It operates at the SNP baud rate of 19.2K baud. The user must follow all GE Fanuc cable termination procedures for cabling from GE Fanuc modules to OCMs. (The user may purchase interconnect cables from Phoenix Digital for connection of OCM-SNP modules to SNP communication devices).

1.3.2 OPTICAL NETWORK INTERFACE SPECIFICATIONS

The Optical Network Interface is designated as ChA Tx/Rx and ChB Tx/Rx on the OCM faceplate (see Figures 3 and 4). The OCM module is compatible with either SMA 905/906 or ST style fiber optic connectors (mating connector which is terminated to the fiber media). (Alignment sleeves should be provided on all SMA Style 906 connectors for optical alignment.) Detailed specifications describing optical network transmit and receive capabilities at the 850nm multimode, 1300nm multimode, and 1300nm singlemode wavelengths are provided below:

Optical Transmitter (850nm Multimode)

Electro-Optical Characteristics

Parameter	Test Condition	SYM.	MIN.	TYP.	MAX.	UNITS
Fiber Coupled Power	50/125 μm, Graded, 0.20NA	P_{oc}	10/-20.0	20/-17.0		μW/dBm
	62.5/125 μm, Graded, 0.28NA		21.9/-16.6	45/-13.5		μW/dBm
	100/140 μm, Graded, 0.29NA		58.0/-12.4	115/-9.4		μW/dBm
	200/230 μm, Graded, 0.37NA		320/-4.9			μW/dBm
Peak Wavelength		λ_P		850		nm
Spectral Bandwidth		$\Delta\lambda$		50		nm

TABLE 2

Optical Transmitter (1300nm Multimode)

Electro-Optic Characteristics

Parameter	Test Condition	SYM.	MIN.	TYP.	MAX.	UNITS
Fiber Coupled Power	50/125 μm, Graded, 0.20NA	P_{oc}	25/-16.0			μW/dBm
	62.5/125 μm, Graded,0.28NA		50/-13.0			μW/dBm
Wavelength		λ	1290		1350	nm
FWHM		$\Delta\lambda$			160	nm

TABLE 3

Optical Transmitter (1300nm Singlemode)

Electro-Optic Characteristics

Parameter	Test Condition	SYM.	MIN.	TYP.	MAX.	UNITS
Fiber Coupled Power	9/125 μm	P_{oc}	16/-18.0			μW/dBm
Wavelength		λ	1270		1340	nm
Spectral Width		Δλ	70		90	nm

TABLE 4

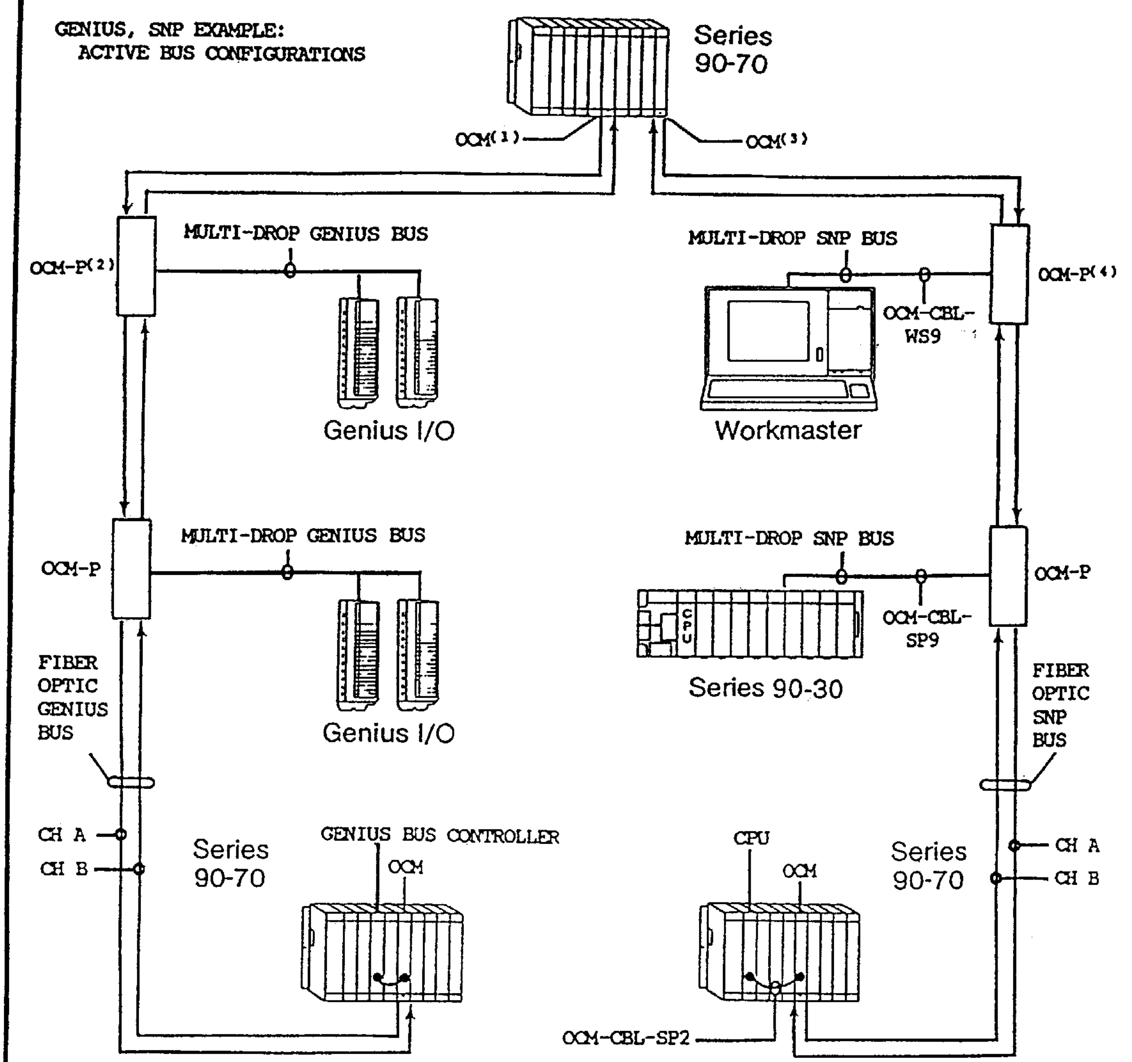
Optical Receiver (850nm multimode, 1300nm multimode, and 1300nm singlemode)

Receiver Sensitivity: -32dbm

OCMs may be interconnected on the fiber optic network in an active bus configuration. Network Channel A Receive Data inputs and Transmit Data outputs should be interconnected sequentially from OCM to OCM in one direction, and Channel B Receive and Transmit Data inputs and outputs interconnected sequentially in the opposite direction. This configuration may be made fault tolerant by cross-connecting Channel A (Ch A Transmit to Ch A Receive) and Channel B (Ch B Transmit to Ch B Receive) on the OCMs on either end of the active bus (See Figures 5 and 6). This effectively transforms the network into a GE Fanuc Genius or SNP counter-rotating ring network configuration.

1.3.3 DIAGNOSTIC OUTPUT SPECIFICATIONS (Available with "-D" Option Only)

The Diagnostic Output Interface is provided on the lower back connector (P2) of the 90/70 Plug-In OCM module and the bottom of the Standalone, Panelmount OCM enclosure (see connector designations J2 and J3 in Figure 4). Diagnostic status information is provided for each of the two redundant fiber optic communication network channels. Diagnostic status includes both digital (discrete - hi/low) and analog (0 to +10 VDC) information pertaining to fault and impending fault network conditions.



(1) GENIUS OPTICAL COMMUNICATION MODULE
MODEL# OCM-GEN-85-D-ST

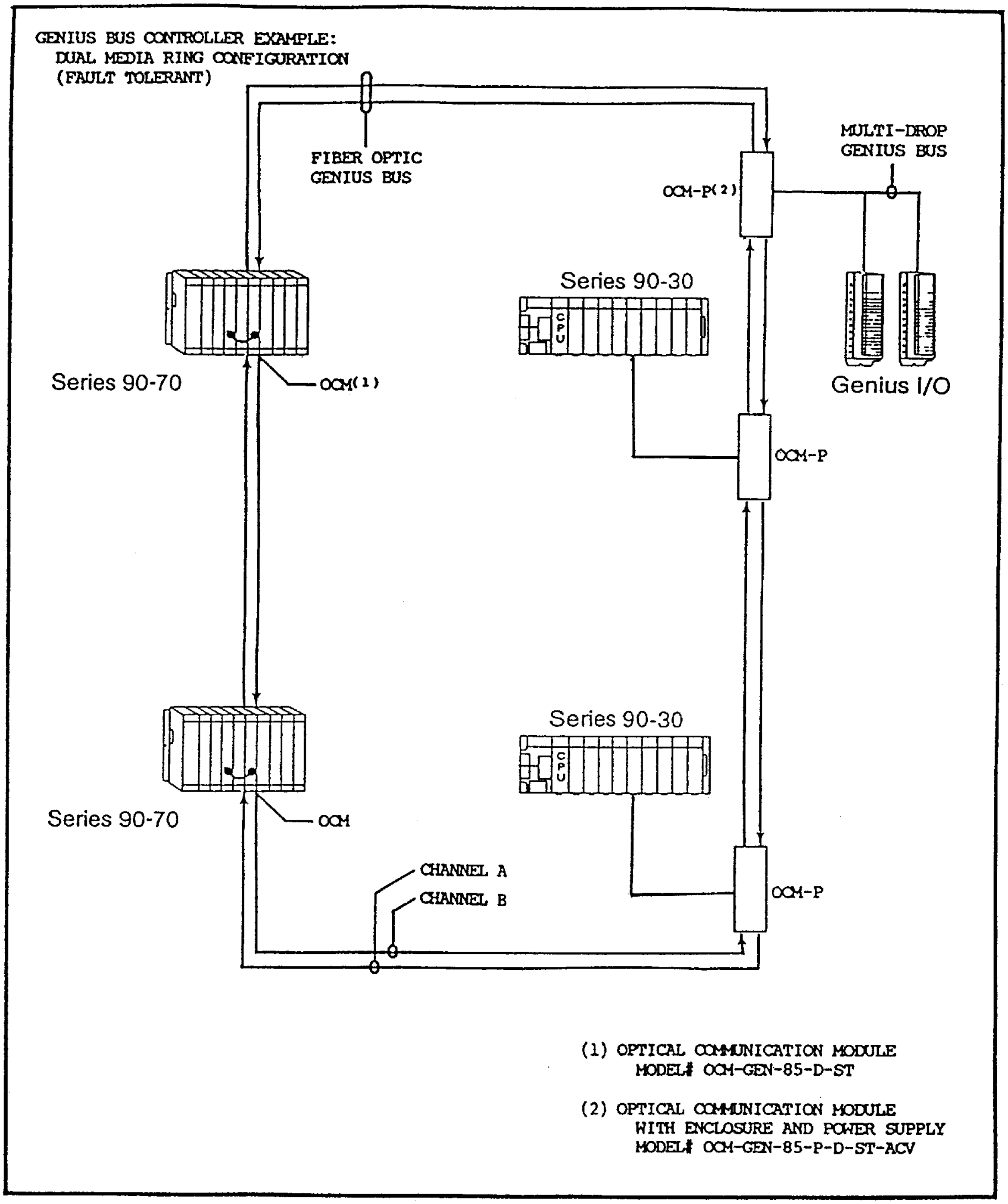
(2) GENIUS OPTICAL COMMUNICATION MODULE
MODEL# OCM-GEN-85-P-D-ST-ACV

(3) SNP OPTICAL COMMUNICATION MODULE
MODEL# OCM-SNP-85-D-ST

(4) SNP OPTICAL COMMUNICATION MODULE
MODEL# OCM-SNP-85-P-D-ST-ACV

TYPICAL OCM INSTALLATION CONFIGURATION

FIGURE 5



TYPICAL OCM INSTALLATION CONFIGURATION

FIGURE 6

Plug-in OCM module connector designations for diagnostic status outputs are the following:

Plug-In OCM Connector Designation (P2)	Signal Name
A14	RSS Return
A15	ChA Receive Signal Strength (RSS)
A16	RSS Return
A17	ChB Receive Signal Strength (RSS)
A18	ChB Communication Error (ERR)
A19	ChA Communication Error (ERR)
A21	ChB Impending Fault Detect (IFD)
A24	ChA Impending Fault Detect (IFD)
A11	Isolated +VDC
A22	Isolated -VDC (Signal Ground)
C18	Signal Ground (-VDC)
C19	Signal Ground (-VDC)

Standalone, Panelmount OCM terminal barrier strip designations are the following:

J2/J3 Connector Pin #	DC Power/ Diagnostic Output Signal Name
J2/1	Channel A Impending Fault Detect (IFD)
J2/2	Signal Ground (IFD/ERR Reference Ground)
J2/3	Channel A Communication Error (ERR)
J2/4	Chassis Ground
J2/5	Primary +5VDC (Primary Input Power)
J2/6	Primary COM (Primary Input Power Common)
J2/7	Primary +12DC (Primary Input Power)
J2/8	Primary -12DC (Primary Input Power)
J3/1	Isolated +VDC (Diagnostic Input Power)
J3/2	Isolated -VDC (Signal Ground)
J3/3	Channel B Impending Fault Detect (IFD)
J3/4	Signal Ground (IFD/ERR Reference Ground)
J3/5	Channel B Communication Error (ERR)
J3/6	Channel A Receive Signal Strength (RSS)
J3/7	ChA/B RSS Return
J3/8	Channel B Receive Signal Strength (RSS)

OCM DC POWER/DIAGNOSTIC OUTPUT PIN DEFINITIONS

TABLE 5

The Standalone, Panelmount OCM may be ordered for operation from either a 110/220 VAC or 24 VDC power source. The OCM power supply is attached to the left side of the OCM enclosure and is prewired at the factory to the OCM Module Primary DC power inputs on J2 connector pin numbers 4 thru 8. (See Section 1.3.5 for more detailed information.)

General purpose discrete electrical outputs (activate low true), two per optical network receive input, are provided for network diagnostic conditions of Impending Fault Detection and Communication Error. These outputs may be utilized to activate optical bypass switches on the network, for control system monitoring of diagnostic network conditions, or merely to annunciate network diagnostic status (alarm, pilot light, etc.). (Independent outputs are provided for each network channel - ChA, ChB.) They are optoisolated for overvoltage protection, and are configured at the factory (factory default) to operate from an isolated, external DC power supply (Terminal barrier strip designations J3/1= Isolated +VDC, J3/2 = Isolated -VDC). A functional description for IFD, ERR, and Isolated ±VDC is provided in Section 2.6. Electrical specifications are the following:

Discrete Outputs (ChA IFD, ERR; ChB IFD, ERR)

Isolated Power Supply (J3/1, J3/2)

V_{ps} = 32.0 VDC (max)
4.0 VDC (min)

Electrical Isolation (Assuming Isolated ±VDC Operation)

V_{ISO} = 1500 VDC

Outputs (Activated Low True)

R_S = 4.7k Ohm
I_{OL} = 100 ma (max)
V_{OL} = 1.5 VDC (max @ $I_{(out)}$ = 100 ma)

Linear voltage outputs (analog) are also provided, one per optical network receive input. These outputs provide an absolute +DC voltage representation of the optical power level or Receive Signal Strength (RSS) for each network receive input. The RSS outputs are buffered for increased drive current capability. RSS output specifications are the following:

Linear Outputs (ChA RSS, ChB RSS)

Voltage Range (V_{out}) = 0 to +10 VDC

Drive Current (I_{out}) = 20 ma (max)

Network Optical Power-In Versus RSS Voltage-Out (Analog)

Optical Power In (dbm @ 850nm)	Optical Power In (dbm @ 1300nm, multimode)	RSS $V_{(out)}$*
-18.0	-20.0	10.0
-18.2	-20.2	9.5
-18.4	-20.5	9.0
-18.7	-20.7	8.5
-19.0	-20.9	8.0
-19.2	-21.2	7.5
-19.5	-21.5	7.0
-19.9	-21.8	6.5
-20.2	-22.2	6.0
-20.6	-22.5	5.5
-21.0	-23.0	5.0
-21.5	-23.4	4.5
-22.0	-23.9	4.0
-22.6	-24.5	3.5
-23.2	-25.2	3.0
-24.0	-26.0	2.5
-25.0	-26.9	2.0
-26.2	-28.2	1.5

*Proportional Accuracy: $\pm$ 1.0 volt (0°to 60°C).

TABLE 6

Chassis ground and signal ground connections are also provided on the OCM terminal barrier strips for IFD, ERR, and RSS. It is recommended that chassis ground be used for shielding all signal cables, Signal Ground (-VDC) be used as the isolated reference for IFD and ERR, and RSS Return be used as the common reference for RSS analysis. (It can also be used as the negative signal reference for differential analysis of RSS.)

Since the diagnostic outputs on the OCM are active the user must insure electrical compatibility before connection to controller input modules.

1.3.4 NETWORK INSTALLATION SPECIFICATIONS

SNP NETWORKS
SNP devices must be configured for multi-drop port connection, 19.2K baud, and "0" modem turnaround time. They require no special installation sequence. SNP OCMs may be daisychained on a fiber optic network as shown in Figure 5 and described in Section 1.3.2.

GENIUS NETWORKS
Genius devices must be configured for 153.6K EXT baud rate. Fiber optic Genius network installations require that simple installation guidelines be observed, as related to the Genius network protocol. These guidelines **DO NOT** restrict the distributed functionality of the Genius network. OCM Genius devices may be located anywhere on the fiber optic Genius network, just as on a hardwired Genius network. However, in certain applications where large numbers of Genius devices are present or where long distances exist between Genius devices, a simple rule of thumb should be applied for assigning Genius node addresses. Genius network node addresses define the order in which devices communicate on the network, and are dynamically reconfigurable (independent of the network application) by the portable Genius Hand-Held-Monitor (HHM). These node addresses can be reconfigured at any time to add/delete nodes, etc., without affecting control software protocol. After the Genius devices are installed on the network the corresponding node address numbers (0-31) should be configured at each Genius device in a numerically sequential order around the fiber optic Genius network, in the direction of the primary fiber optic communication channel (Channel A). Two or more node addresses must be allocated (either used for active Genius devices or reserved) on each OCM stub (drop) in the base Genius network configuration, as a function of overall network distance. The following table defines the maximum overall base Genius network distance (total distance in ring configuration) versus the minimum number of nodes allocated at each OCM stub:

Minimum # Genius Nodes Allocated at Each OCM Stub	Maximum Overall Fiber Optic Genius Network Distance[1]
2	4 miles (6.4 km)
3	7 miles (11.2 km)
4	10 miles (16.0 km)
5	13 miles (20.8 km)
6	16 miles (25.6 km)
7	19 miles (30.4 km)
8	22 miles (35.2 km)
etc.	etc.

Genius Node Address Allocation
Versus Overall Network Distance
For Base Network Configuration

[1] Longer Distances are available. Consult the factory for more information.

Genius devices should be assigned to these node addresses beginning with the lowest node address number allocated at any given stub. Since node addresses rotate sequentially in the Genius network protocol 0, 1, 2, 3... 28, 29, 30, 31, 0, 1, 2, 3... 28, 29, 30, 31, 0, 1, 2, 3, etc., the lowest node address is defined as the first in the order of rotation. (In other words, if 0 and 1 are the only two Genius devices co-located on the same OCM stub then 0 is the lowest node address... first in rotation. But if 31 and 0 are co-located on the same stub then 31 is the lowest node address... first in rotation). In a fixed network installation of this type up to 16 OCMs may be located on a single Genius network.

When the portable Genius HHM is used on a Genius network special rules must be applied to allow attachment of the HHM to any node on the Genius network, independent of network configuration. It is recommended that the Genius Bus Controller be configured to communicate at node address 31 (factory default), and that all but one Genius device and the HHM be configured for consecutive node addresses (beginning at node address 0) in ascending order... in the direction of network Channel A (in compliance with the base Genius network maximum overall distance guidelines described above). The one Genius device which has not yet been assigned a node address should be physically located at the furthest point on the network from the Genius Bus Controller (in the direction of Channel A). Node addresses may now be assigned to the one unassigned Genius device and the HHM. These two node addresses should be selected such that they are offset by an amount which evenly divides the remaining unused Genius node addresses (excluding those already allocated and/or reserved in the base Genius network configuration) into 3 approximately equal blocks (± 1 node address). The HHM should be self-configured for the lower and the remaining Genius device the higher of these two node addresses. This will allow attachment of the HHM to any node on a Genius network with an overall length which may be computed using the following table:

# Unused Genius Nodes[1]	Maximum Overall Fiber Optic Genius Network Distance for HHM Compatibility[2]
3 to 5	2 miles (3.2 km)
6 to 8	5 miles (8.0 km)
9 to 11	8 miles (12.8 km)
12 to 14	11 miles (17.6 km)
15 to 17	14 miles (22.4 km)
18 to 20	17 miles (27.2 km)
21 to 23	20 miles (32.0 km)
etc.	etc.

Genius Node Address Allocation Verses
Overall Network Distance for HHM Application

[1] Excluding node addresses already allocated (used and/or reserved) at each OCM stub for the base Genius network configuration.

[2] Longer distances are available. Consult the factory for more information.

Figure 7 illustrates a typical high density fiber optic Genius network installation with the correct installation sequence for Genius node addresses. In this example 17 Genius devices are distributed on the network (including the HHM), and one Genius node address is reserved but not used (Node 14) to accommodate the maximum base Genius network distance guidelines described above. The Primary Fiber Optic Genius Channel (Channel A) is oriented in a clockwise direction and the Secondary Channel (Channel B) is oriented in a counterclockwise direction. Therefore, the Genius device node addresses are sequentially ordered in a clockwise direction, in the direction of Channel A. The 14 unallocated (unused and not reserved) node addresses are divided into three blocks of four, five, and five. These blocks are logically positioned as node address gaps between node addresses 14 (unused but reserved) and 19 (HHM), 19 and 25 (furthest Genius device from the Genius Bus Controller on Channel A), and 25 and 31 (Genius Bus Controller). This enables attachment of the HHM anywhere on a Genius network with an overall distance of 10 miles (16 km)! (Limited only by the base Genius network maximum overall distance guidelines.) The letter "T" is located next to the Genius devices and/or OCMs where termination resistors are required across the Serial 1/Serial 2 connections on the hardwired multi-drop Genius network. As in the case of hardwired Genius networks the Genius devices (or OCM-GENs) on either end of the local Genius busses must be terminated. Local Genius multi-drop busses located at each OCM must adhere to standard Genius LAN installation guidelines.

1.3.5 POWER SUPPLY AND GROUNDING SPECIFICATIONS

1.3.5.1 90/70 PLUG-IN OCM

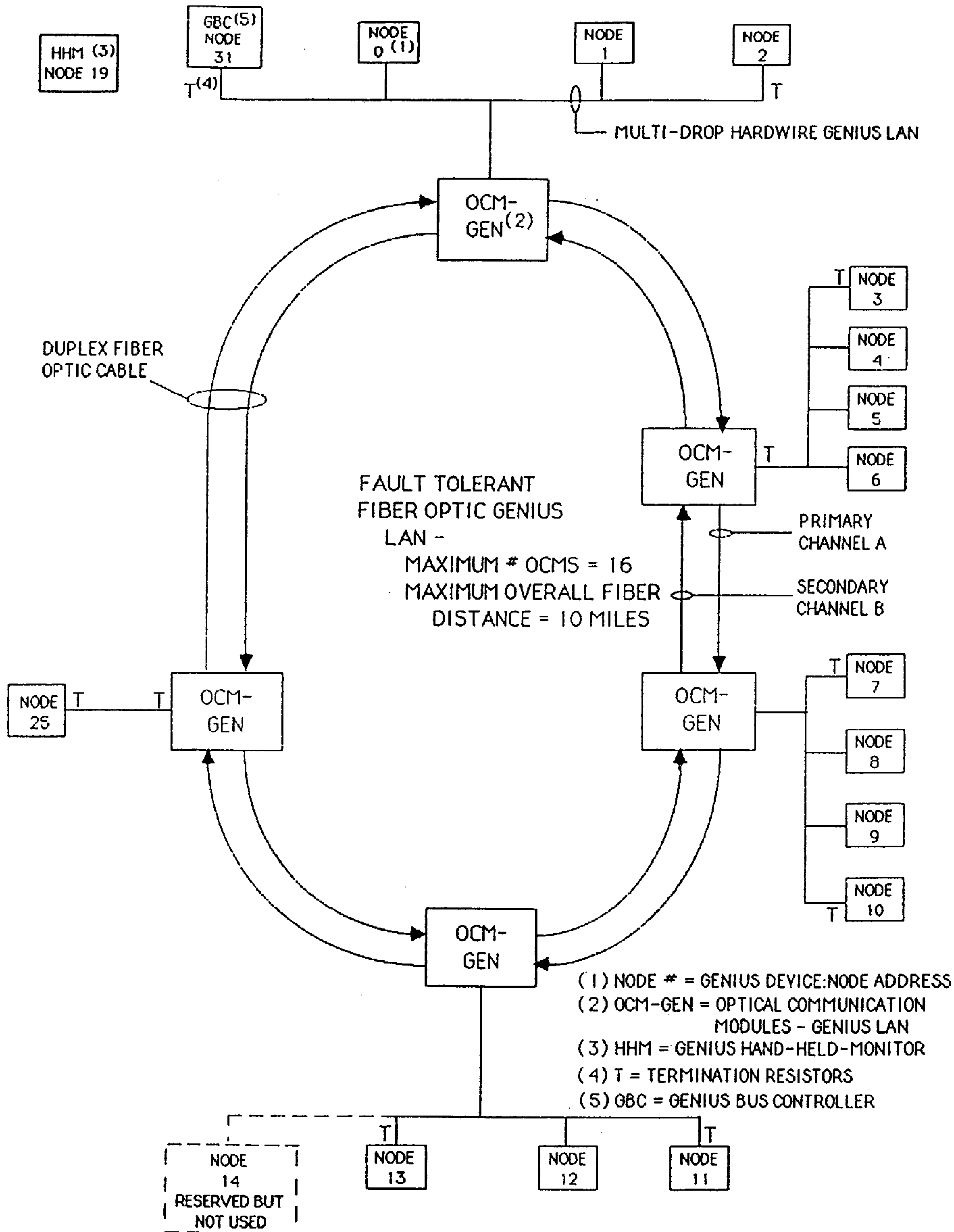
Power Supply	:	+5V DC @ 1.5 amps, +12V DC @ 100 ma., -12V DC @ 200 ma. GE Fanuc Series 90-70 PLC Power Supply Catalog Number 1C697PWR711 (or equivalent) is required.

1.3.5.2 POWER SUPPLY AND GROUNDING SPECIFICATIONS

OCM modules may be ordered as standalone modules, or with either a 120/220 VAC or 24 VDC power supply. The power supply will be attached to the left side of the OCM enclosure.

1.3.5.2.1 110/220 VAC OCM POWER SUPPLY SPECIFICATION

Input Voltage Range	:	85 VAC to 264 VAC
Input Frequency Range	:	47 Hz to 440 Hz
Conducted RFI (Input Line Filter)	:	FCC limit B and VDE limit A
Hold-Up Time	:	12 milliseconds



TYPICAL FIBER OPTIC GENIUS LAN INSTALLATION

FIGURE 7

Power Consumption UL, CSA, VDE Approved	:	10 watts per OCM (approximate)
Fuse[1]	:	2 AMP, 250 VAC, SLO BLO (.8 inch/20 millimeter)

(1) The Fuse is mounted on the internal printed circuit board of the AC Power Supply. For fuse access the user must remove the Power Supply from the side of the base OCM enclosure.

1.3.5.2.2 +24 VDC OCM POWER SUPPLY SPECIFICATIONS

Input Voltage Range	:	+20 VDC to +30 VDC
OCM Input Current	:	.6 Amps
Regulation (Load and Line)	:	.6% (min)
Fuse[1]	:	3 AMP, 250 VAC, SLO BLO (.8 inch/20 millimeter)

(1) The Fuse is mounted on the internal printed circuit board of the 24 VDC Power Supply. For fuse access the user must remove the Power Supply from the side of the base OCM enclosure.

1.3.5.2.3 POWER SUPPLY P1 BARRIER STRIP PIN DESIGNATIONS

Tables 7 and 8 provide input power pin definitions (respectively) for the OCM power supply P1 barrier strip (see Figure 4):

P1 Barrier Strip Pin Designation	Signal Name (Pin Definition)
L1	AC Power In (High Line)
L2	AC Power In (Neutral)
⏚	Chassis Ground

AC INPUT POWER BARRIER STRIP PIN DEFINITIONS

TABLE 7

P1 Barrier Strip Pin Designation	Signal Name (Pin Definition)
+VDC	+24VDC In
-VDC	+24VDC Reference
⏚	Chassis Ground

+24VDC INPUT POWER BARRIER STRIP PIN DEFINITIONS

TABLE 8

1.3.5.2.4 ELECTRICAL GROUNDING

The OCM enclosure must be electrically connected to earth ground. This may be accomplished by connecting the Chassis Ground on either the base OCM J2 connector or Power Supply P1 connector to earth ground, or by attaching a ground electrode directly to the module cover. Figure 8 illustrates how to attach a ground lug to the module cover by using one of the module mounting bolts. To ensure a good electrical connection between the ground lug and the module, remove paint from the cover where the lug makes contact. Connect the ground lug to earth ground with an adequate grounding electrode.

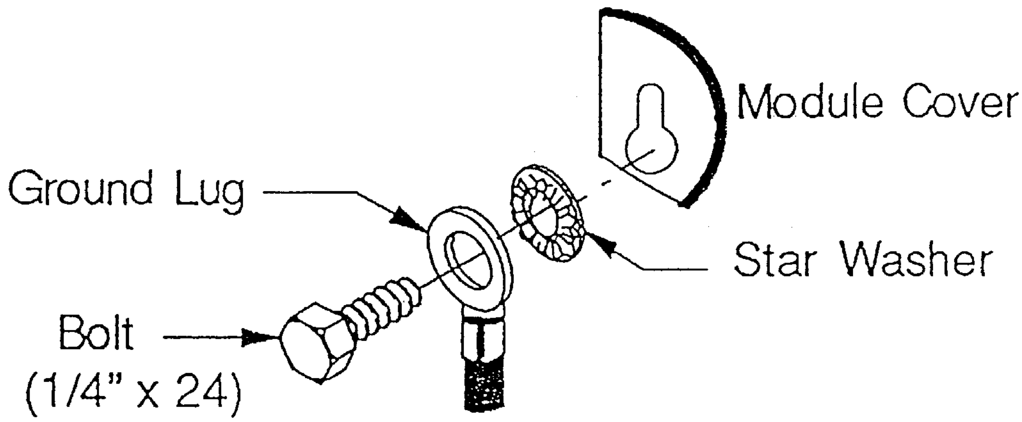
1.3.6 MECHANICAL, ENVIRONMENTAL, AND ELECTRICAL SPECIFICATIONS

90/70 Plug-In Module: Single Slot, 90/70 System Chassis

Standalone, Panelmount Module Dimensions (HxWxD):
10.38"H x 1.76"W* x 7.00"D
(26.36cm H x 4.47cm W* x 17.78cm D)
*Add 1.00" (2.54cm) for rear panel flange (see Figure 4 for more detailed information)

Temperature : Operating 0°to 60°C
Storage -20°C to +70°C

Relative Humidity : 0 to 90% (non-condensing)



OCM ENCLOSURE ELECTRICAL GROUNDING PROCEDURE

FIGURE 8

CHAPTER 2

CONFIGURATION AND INSTALLATION INSTRUCTIONS

This chapter provides preparation for use and installation instructions (including unpacking and inspection instructions), and a functional description of indicators, diagnostic input/output connections, and power connections.

2.1 UNPACKING INSTRUCTIONS

The OCM is shipped from the factory in shock absorbing materials. Remove the OCM from the packing material and refer to the packing list to verify that all items are present. Save the packing materials for future storage or reshipment.

NOTE: If the shipping carton is damaged upon receipt, request that the carrier's agent be present while the unit is being unpacked and inspected.

2.2 INSPECTION

The OCM should be inspected visually for damage upon removal from the shipping container.

2.3 INSTALLATION MOUNTING PROCEDURE

Plug-In OCMS plug directly into GE Fanuc Series 90-70 Chassis and require no special installation mounting. Standalone, Panelmount OCM must be panel-mounted. OCMs are convection cooled, requiring no fan or forced air cooling. An unobstructed air space must be maintained above and below the OCM (6 inches minimum) to insure adequate convection airflow. The mounting specifications for Standalone OCMs are contained in Figure 4. The air at the bottom of the OCM enclosure may not exceed 60 degrees celsius (140 degrees F).

2.4 DIAGNOSTIC STATUS INDICATOR DEFINITION (REFERENCE FIGURES 3 AND 4 FOR OCM NOMENCLATURE AND DESIGNATIONS).

(i) Tx (Local) - Illuminates when the transmit data output (transmit data from the Device Interface/J1 to the local device) is active.

(ii) Rx (Local) - Illuminates when the receive data input (transmit data from the local device to the Device Interface/J1) is active.

(iii) ACT (ChA, B) - Illuminates when the corresponding optical network receive input is receiving valid data.

(iv) ISD (ChA, B Initial Signal Detect) - Illuminates when the corresponding optical network receive input is initialized (see Chapter 3 for Initialization Procedure).

(v) IFD (ChA, B Impending Fault Detect) - Illuminates when the corresponding optical network receive input power level drops 1.5 decibel-milliwatts (optical) below the Initial Signal Strength.

(vi) ERR (ChA, B Communication Error) - Illuminates when the corresponding optical network receive input fails to detect valid data communications.

2.5 ISS POTENTIOMETERS

(i) ISS (Initial Signal Setting Potentiometers) - Initializes Impending Fault Detection thresholds for the corresponding optical network receive inputs (see Chapter 3 for Initialization Procedure).

2.6 DIAGNOSTIC STATUS INPUT/OUTPUT CONNECTIONS

(i) IFD (ChA, B Initial Fault Detect) - Switches (low true) when the corresponding optical network receive input power level drops 1.5 decibel-milliwatts (optical) below the initial signal strength.

(ii) ERR (ChA, B Communication Error) - Switches (low true) when the corresponding optical network receive input fails to detect valid data communications.

(iii) RSS (ChA, B Receive Signal Strength) - Provides a linear voltage representation (analog - scaled from 0 to +10 VDC) for the corresponding optical network receive input.

(iv) Isolated ±VDC Power Supply - Connection for external DC power supply for isolated IFD, ERR operation.

2.7 OCM AC POWER DEFINITION (REFERENCE FIGURE 4 AND TABLES 7, 8 FOR OCM NOMENCLATURE AND DESIGNATIONS)

2.7.1 AC POWER INPUTS

(i) L1, L2 (AC High, Low respectively) - Provides 110/220 VAC, 60/50Hz operation, configurable by the user.

2.8 OCM DC POWER DEFINITION (REFERENCE FIGURE 4 AND TABLES 7, 8 FOR OCM NOMENCLATURE AND DESIGNATIONS)

2.8.1 DC POWER INPUTS

(i) +V, -V (+24 VDC, Reference Ground, respectively) - Provides 24 VDC operation.

CHAPTER 3

IMPENDING FAULT INITIALIZATION PROCEDURE

The OCM module provides the unique capability to detect impending optical communication faults on the fiber optic network before they actually occur. This impending fault monitoring capability, together with the self healing, fault tolerant features described in Chapter 1, makes Phoenix Digital's OCM module the most reliable, user friendly, "maintenance friendly" optical modem on the market today.

The OCM impending fault monitoring circuitry must be initialized upon system start-up. Thereafter, the OCM impending fault detection threshold characteristics will be maintained indefinitely. The impending fault initialization procedure is accomplished through the simple adjustment of two potentiometers, one per optical network communication channel, located on the front of the OCM module. No meters, gauges, or any other type of electrical or optical measurement equipment is required for OCM initialization. The initialization procedure is accomplished by first connecting the OCM module optical receive inputs to the optical transmit outputs of adjacent OCM module(s) (adjacent on the fiber optic network), with the actual fiber optic cable to be used in the final installation. (It is recommended that this initialization be accomplished post-installation in order to match the OCM impending fault monitoring circuitry to the final communication link characteristics.) The adjacent OCMs (adjacent on the fiber optic network) must be powered during the initialization process to provide a receive signal reference (communication data carrier) to the OCM undergoing initialization. OCMs must be powered for at least 15 minutes prior to initialization in order to stabilize all internal references. (The initialization procedure may also be performed on-line with actual network data transmissions, and will be totally transparent to network operation.) While visually observing the ISD indicators on the front of the OCM module the ISS potentiometers should be turned counterclockwise if the corresponding green ISD indicators are off, or clockwise if they are on, until the ISD indicators switch state (either turning on to off or off to on). Then, as the final step, the ISS potentiometers should be turned 1/4 turn counterclockwise, at which point the corresponding ISD indicators should be maintained continuously on.

The OCM initialization procedure normalizes the impending fault monitoring detection thresholds to the attenuation characteristics of the final network installation. (It should be noted that the ISD indicator may occasionally flash on or off, or turn off entirely over time. This is a normal operating condition and should be ignored post installation.) After initialization any optical network fault condition which causes the optical network receive power level to drop by more than 1.5 decibel-milliwatts (optical power) relative to the initialization power level will cause the corresponding Impending Fault Detect (IFD) indicator (red) to illuminate. Thus, the impending fault monitoring circuitry will detect and annunciate impending optical communication faults resulting from any number of different optical network fault conditions; media deterioration, transmitter degradation, etc. No additional calibration adjustments will be required for the lifetime of the network installation, unless the network characteristics are changed. Changes affecting either the optical characteristics of the network media (media replacement, splice, new terminations, etc.) or replacement of one or more OCMs will require that the initialization procedure be repeated for each OCM which has one or more of its' optical network receive inputs affected by the change. (The initialization procedure may be done on-line, post installation, and will not affect real time network data transmissions.)

APPENDIX A

OCM TRAP MODE OPERATION

Phoenix Digital's OCMs provide fault tolerant network communications. OCMs self heal communication failures on the fiber optic network by wrapping back communication around points of failure. In this way Phoenix Digital's OCMs detect, isolate, and correct failures anywhere on the network grid. Once the source of a network failure is corrected the OCMs automatically restore the fiber optic network to its original configuration. (See Section 1.2.1 for more detailed information.)

When a fiber optic communication failure occurs it normally causes the network to remain in a failed condition until the source of the failure is identified and corrected (solid failure). The diagnostic outputs of the OCM enable network maintenance personnel to quickly locate this type of failure. However, an intermittent communication failure may occur, causing the network to briefly fail and then automatically recover. This type of failure can be very difficult to locate because it does not remain in the failed condition long enough for maintenance personnel to locate the source of the problem.

Phoenix Digital's OCMs are jumper configured at the factory for automatic recovery from communication failures. In the Auto-Recovery Mode of operation OCMs automatically detect, isolate, and correct communication failures by switching the network around the points of failure, and then automatically restore the network to its original configuration when the source of the failures is corrected. However, as an alternative to Auto-Recovery Mode, OCMs may be jumper configured by the user for TRAP Mode Operation. In Trap Mode, OCMs help detect and locate intermittent fiber optic communication failures. Trap Mode OCMs will continue to automatically detect, isolate, and correct communication failures, just as in Auto-Recovery mode. But when the source of the failures is corrected the Trap Mode OCMs will **NOT** automatically restore the network to its original configuration. Instead, the network will remain trapped in the failed condition until the source of the failures is corrected **AND** the trapping OCMs are reset. Thus, intermittent failures will be continuously trapped by the OCMs (latched), providing maintenance personnel with the necessary time to locate and correct the source of the network failures.

When Trap Mode is selected (OCM jumper selection) OCMs must be initialized for network communications in the following manner:

1. Install and interconnect all OCMs on the network with fiber optic cable, in the appropriate network configuration. (Note that if the OCMs on the fiber optic network are not properly interconnected with fiber optic cable the OCMs will assume that the improper connection is an intermittent failure and trap the failure accordingly.)

2. Apply power to all of the OCMs on the network. (At this point all of the OCMs configured for Trap Mode operation should indicate a failed condition on both channels... Ch A, B ERR).

3. Depress the TM Pushbutton on the front panel of each Trap Mode OCM on the network. This will switch the OCM into an active, on-line, error free mode of operation, until such time as an intermittent communication failure occurs and the OCM traps the failure. (See Figure 3 for the OCM TM Pushbutton front panel designation.)

4. Trap Mode OCMs may be subsequently reset (after trapping an intermittent failure) by depressing the TM Pushbutton.

Figure A-1 provides an overview of the OCM internal module, illustrating the Trap Mode jumper locations. Table A-1 provides instructions for Auto-Recovery/Trap Mode jumper selection.

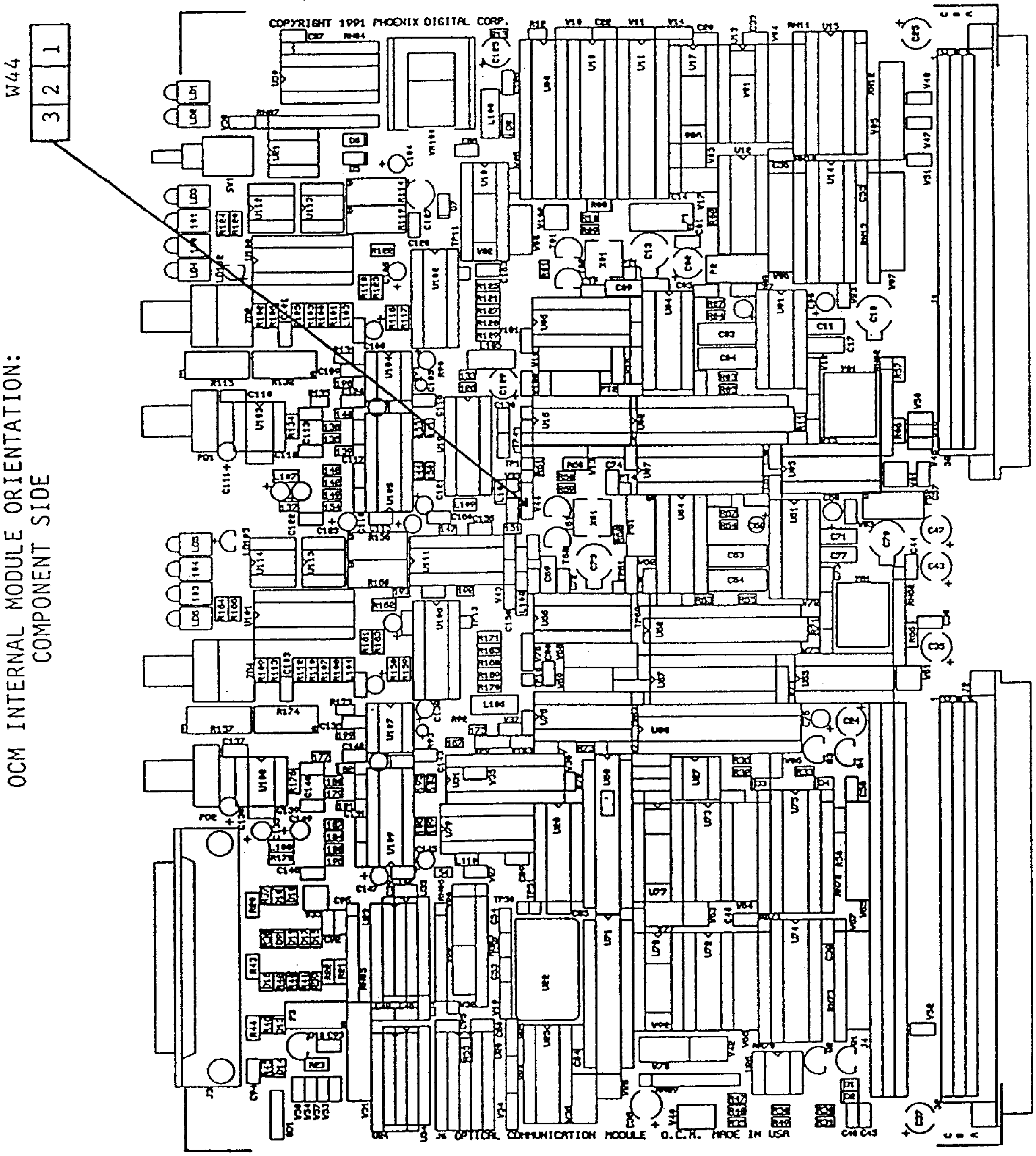
Auto-Recovery/ Trap Mode Selection	Jumper Designations[1] W44 1-2	W44 2-3
Auto-Recovery[2]	Jumper Out	Jumper In
Trap Mode	Jumper In	Jumper Out

(1) See Figure A-1
(2) Factory Default Setting

AUTO-RECOVERY/TRAP MODE SELECTION

TABLE A-1

OCM INTERNAL MODULE ORIENTATION:
COMPONENT SIDE



OCM JUMPER CONFIGURATION OVERVIEW - BASE MODULE

FIGURE A-1