Installation and Service Guide

Agilent Serial Distribution Network (SDN)

78581B Agilent CareNet Controller (ACC)

Agilent Technologies

Part Number 78581-92000
Printed in the U.S.A. February 1, 2001
First Edition

Notice

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Agilent Technologies, Inc.
3000 Minuteman Road
Andover, MA 01810-1099
(978) 687-1501

Publication number
78581-92000
Printed in USA

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Printing History

New editions of this document will incorporate all material updated since the previous edition.

The documentation printing date and part number indicate its current edition. The printing date changes when a new edition is printed (minor corrections and updates that are incorporated at reprint do not cause the date to change). The document part number changes when extensive technical changes are incorporated.

First Edition. . . . . February 2001

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Contents

Section 1: Introduction

SDN System Description

The Serial Distribution Network (SDN) is a local area communications network designed to share patient physiological parameters and other data among bedside instruments, information centers (IC), recorders, thermal printers, computer systems, and other information systems connected to the system. The SDN is a digital communications network that allows real-time transfer of digitized patient data between these instruments. The communication protocol, data formatting, and hardware implementation is intended to be flexible enough to accommodate a variety of communication needs in the patient monitoring environment for present and future expansion.

SDN Components

The components of the SDN consist of the model 78581B Agilent CareNet Controller (ACC), the SDN interface circuitry located within each instrument connected to the SDN, and the system distribution cables (branch cables), local distribution cables, and the associated wallbox hardware, connectors and receptacles. The components of the SDN are shown on page 1-2, and a typical SDN configuration is illustrated in Figure 1-2 on page 1-3.

SDN Operation

The SDN functions automatically without user interaction and without direct patient connections. Digitized patient information from each instrument (branch) is transmitted serially at regular intervals (called poll cycles) over branch cables to the ACC. The ACC sequentially receives, synchronizes, and rebroadcasts the digitized patient information to all instruments connected to the SDN. This patient data is received for use by each instrument via the SDN interface circuity resident in each instrument. Patient data are not restricted or allocated by the network, but are accepted from, and transmitted to, all instruments within the system. Each instrument decides for itself which patient information it wants to acquire and process. Each instrument gets a chance to transmit and receive patient information every poll cycle. A poll cycle lasts 32 ms, thus, there are approximately 32 poll cycles per second.

Digitized patient information transmitted over the SDN may be either waveforms (for ECG, pressure, and respiration) or parametric information (for heart rate/pulse, pressure valves, and respiration rate). The SDN data transmission rate of 3.6 Mbits can provide up to 7700 usable 12-bit data words per 32-millisecond poll cycle. The SDN is a half-duplex network using terminated shielded twisted pair cable(s). All data is transmitted differentially and serially using block code modulation. A detailed description of the SDN system theory of operation is given in a subsequent section of this manual.

Within the connected instruments, SDN interface circuitry provides the link between the serial digital network, and the instrument connected to the SDN (except the ACC) has basically the same interface circuitry, most of which is contained on a custom integrated circuit called the SDN Interface Circuit Chip (SIC Chip). A detailed description of the SIC Chip theory of operation is given in a subsequent section of this manual.

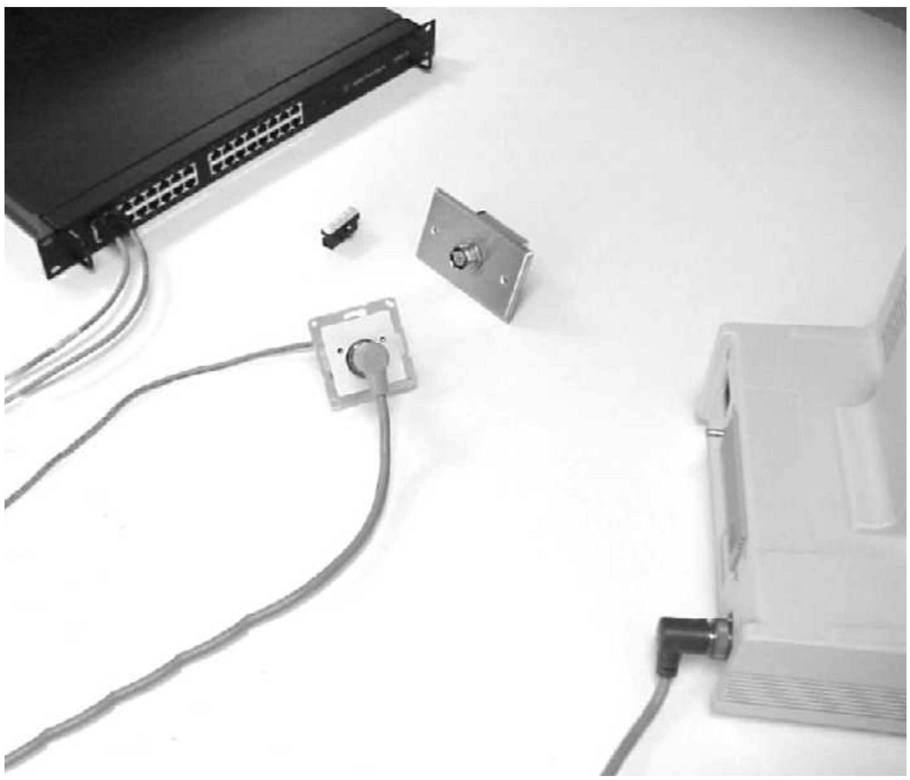


Figure 1-1. SDN Components

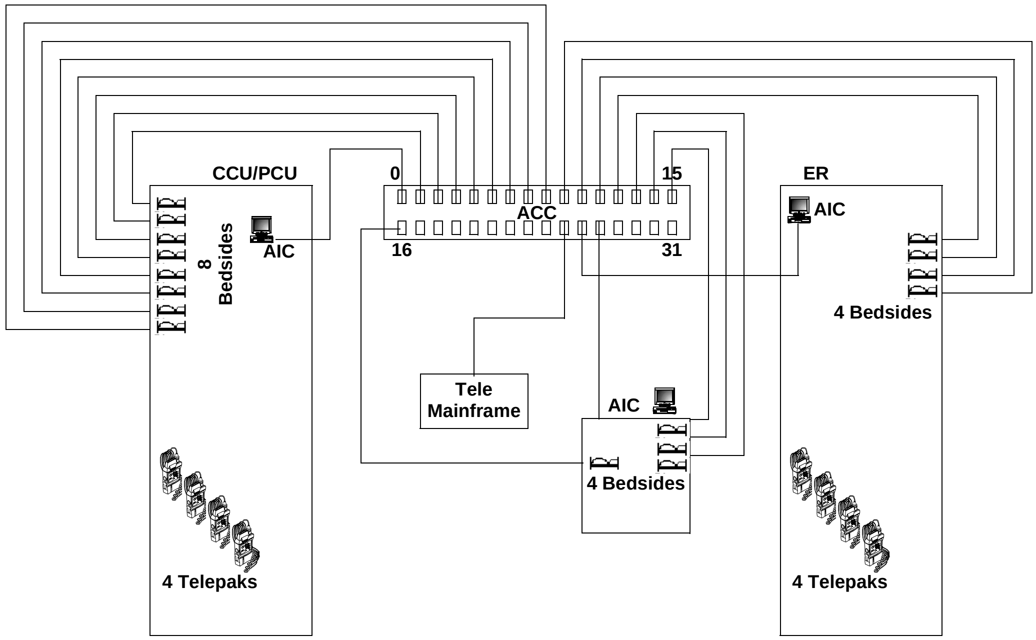


Figure 1-2. Typical SDN Configuration

Operating Reliability — Failure/Restart

Power Failure: ACC operation resumes automatically after power restoration. Loss of power to the ACC will not affect local operation between instruments on a branch that do have power. Loss of power at one instrument on a branch will not disrupt system communication of other instruments on the same branch or any other branch of the network.

SDN Configurations

Various combinations of patient monitors and patient information centers may be connected to the ACC providing the system is configured within the certain restrictions and limitations.

The ACC can accommodate up to 32 separate branch cables emanating from it to the wall boxes (instruments). Of the 32 total branches, 24 may connect to HP and Agilent bedside instruments (one patient per branch—see note below), 6 may connect to information centers, and 2 may connect to computerized systems. Refer to the installation section of this manual for a complete listing of SDN System, ACC, cables, and wall boxes restrictions and limitations.

Agilent CareNet Controller (ACC), Model 78581B

The Agilent CareNet Controller (ACC), model 78581B, is the active node—in essence the heart—of the Serial Distribution Network (SDN). The primary functions of the ACC are to provide the physical system communications link to the instruments connected to the SDN, to establish the SDN data polling cycles, and to control the data flow, timing, synchronization, and distribution throughout the system.

The ACC functions in conjunction with the SDN Interface Circuitry located within each instrument connected to the SDN, and with the system distribution cables (branch cables), local distribution cables, and the associated wallbox hardware, connectors and receptacles. A typical SDN system configuration is illustrated in Figure 1-2 on page 1-3.

Once each poll cycle, data from each instrument is transmitted over the branch cables to the ACC. All this data are received in sequence, synchronized, and controlled by the ACC, then transmitted (broadcast) simultaneously to all of the instruments connected to the SDN during each 32-millisecond poll cycle. The data sent over the SDN bus is received for use by each instrument via the SDN interface circuitry residing in each instrument. The ACC cannot store, restrict, or allocate specific distribution of SDN data.

The ACC controls the data communication sequence during the 32-millisecond poll cycle by issuing a variety of system messages that originate in the ACC. A complete description of system messages, instrument messages, the SDN data communicating sequence and SDN bus direction control is described in the SDN system theory of operation section of this manual.

Additionally, the ACC performs some basic fault detection isolation to ensure reliability of SDN system communications. Also included in the ACC are resident self-diagnostic routines for fault detection, troubleshooting, and servicing of the ACC.

The ACC consists of a metal chassis with cover, a Power Supply Assembly, a Terminal Interconnect PC board, and a Control/Driver PC board. The model 78581B Agilent CareNet Controller is illustrated on in Figure 1-3 on page 1-5.

The Control/Driver PC board contains all the electronic circuitry required to control the data flow, timing, and distribution of SDN data throughout the system.

The Terminal Interconnect PC board contains the RJ-45 connection to connect the branch cables to the ACC, and the signal feed-through ribbon cables to the Control/Driver PC board.

The Power Supply assembly contains the power ON/OFF indicator, and a 5-volt linear DC voltage supply used to power the circuitry on the Control/

Driver PC board. This model of the ACC does not have a power ON/OFF switch. Power comes on as soon as it's connected to AC by power cord. To disconnect the power, remove the plug from the wall receptacle.

Figure 1-3. Agilent 78581B Agilent CareNet Controller

ACC Controls and Indicators

There are no operator controls located on the ACC. Once the power cord is connected and the ACC is running properly, no operator adjustments are necessary.

The green power ON/OFF indicator is visible on the rear. When illuminated, it indicates 5-volt power is available from the ACC power supply.

ACC Servicing

The ACC has been designed for ease of servicing. PC board and assembly replacement is the primary method of repair. Troubleshooting tests and integrity routines are specified in detail the ACC Troubleshooting section of this manual. Complete disassembly procedures of the ACC are described in the Installation section of this manual.

Cables, Wall Boxes, and Faceplates

Branch Cables

There are three types of branch cables that are permanently installed to provide long distance connection between the ACC and the wall box; the standard System Distribution Cable (SDC), the Extended System Distribution Cable (XSDC), and Category 5 Unshielded Twisted Pair (UTP).

The length of Unshielded Twisted Pair runs must be less than 90 meters (295 ft.). The length of each standard SDC must be less than 152 meters (500 ft.). The length of each XSDC must be less than 304 meters (1000 ft.). Only two XSDC runs are allowable per ACC. Branch cable runs must be continuous; no splicing or mixing cable types is allowed.

Local Distribution Cables (LDC)

The SDN allows ease and flexibility of user placement of instruments. Local distribution cables (LDC) must be used for local serial connection from the wall box/face plate to the instrument, and to other instruments. The LDC allows bedside instruments to be easily interchanged simply by connecting them to their new locations.

Wall Boxes and Face Plates

Wall Boxes: only standard size, NEMA, single- or dual-gang, switch wall boxes with conduit knockouts (KOs) may be used. The depth of the wall box must be at least 7.0 cm (2.75 in). Wall boxes are usually supplied by the customer; however, two types are available from Agilent Technologies.

Face Plates: Pre-punched, NEMA, single- or dual-gang faceplates for the SDN; SDN on UTP US and European wall boxes. Faceplates are included with the wall box connector kits.

SDN Components

Installation of a complete Serial Distribution Network requires the ordering and selection of several instruments, SDN system components and options. These include the model 78581B ACC and options from the 78599AI/Cabling Installation Kit to provide Local Distribution Cables (LDC) and connector hardware. Branch cables are ordered separately using their associated Agilent part number.

Refer to the Installation section of this manual for a complete description of the installation instructions and responsibilities for properly installing the ACC, the cables, and the wall boxes. The general SDN instrument interconnection procedures are also given in the installation section; however, the specific details of instrument wiring procedures and 'tuning" the instruments into the SDN communications network are explained in detail in the associated instrument's service manual.

The ACC may be mounted on a standard 19 inch telecommunications rack. It may also be wall mounted on a properly prepared wall, using the wall mount kit (M3180AI), that permits the length of each branch cable to be within the specified length limitations. No special tools are required for installation—only screw drivers, cable strippers, and pliers are needed. Environmental conditions, service access requirements, and free space surrounding the ACC are detailed in the Installation section of this manual.

Table 1-1: SDN Branch Cables

System Distribution Cable (SDC)	100-ft. reel 250-ft. reel	8120-3502 8120-3775
Extended System Distribution Cables (XSDC)	500-ft. reel 750-ft. reel 1000-ft. reel	8120-3774 8120-3777 8120-3776
UTP Category 5 Orange	1000-ft. reel	8120-6770

78599AI SDN Cabling Installation Kits

– J01 Single Gang SDN Face Plate/Connector Kit

– J02 Dual Gang SDN Face Plate/Connector Kit

– J12 SDN/UTP Single Wall Box Quantity 1

– J13 SDP/UTP Single Wall Box Quantity 8

– J14 SDN/UTP Dual Wall Box Quantity 1

– J15 SDN/UTP Dual Wall Box Quantity 8

– JJ1 SDN on UTP parts (European) Quantity 1

– JJ2 SDN on UTP parts (European) Quantity 8

– J03 3-Foot Local Distribution Cable (LDC)(81 20-3591)

– J06 6-Foot Local Distribution Cable (LDC)(81 20-3587)

– J10 10-Foot Local Distribution Cable (LDC)(8120-3588)

– J20 20-Foot Local Distribution Cable (LDC)(8120-3589)

– J50 50-Foot Variable Length LDC Kit

– J52 Extra SDN Connectors (Two)

– J54 Fifty Feet of Unterminated LDC

M3199AI Installation Materials

– P01 UTP Plenum (Orange) Cat. 5 Cable 1000 Feet

– J03 RJ45 to SDN Cable Connector

M3180A Wall Mount Kit

– A14 Wall Mount Kit (78581-61257)

Intended Use of Device

The Signal Distribution Network (SDN) allows the sharing of patient physiological parameters and other electronic data among bedside instruments, central station processors and displays, recorders, thermal printers, and other computerized systems.

Warning

United States Federal Law restricts this device to sale by or on the order of a physician.

This product is not suitable for installation in the patient care vicinity.

Section 2: Theory of Operation

Overview

Theory of operation consists of two distinct subsections:

- SDN Theory of Operation
- ACC Theory of Operation

SDN Theory of Operation describes the overall system Serial Distribution Network (SDN), its normal operating characteristics, applications, and error conditions, the format of the SDN digital data, and the SDN system communications protocol as well as the local distribution network (LDN) communications protocol. The SDN system communication protocol and data formatting assures compatibility between a variety of different instruments communicating together over the SDN. The communication protocol and hardware implementation is intended to be flexible enough to accommodate a variety of communication needs in the patient monitoring environment for the present and for future expansion.

ACC Theory of Operation describes the detailed operating theory of the Agilent CareNet Controller (ACC). Included in this section are functional descriptions of the Power Supply Assembly, the Terminal Interconnect PC board, and the detailed operating principles of the Control/Driver PC board which includes the transmit/receive driver circuitry, the retiming circuitry, and the control circuitry.

SDN Theory of Operation

SDN General Description

The Serial Distribution Network (SDN) is a digital communications network designed to share patient physiological parameters and other data among all instruments connected directly to the SDN.

The SDN uses cables containing a twisted shielded pair of wires to connect the instruments to the Agilent CareNet Controller (ACC). Digitized patient data is transmitted SERIALLY through the wires of the NETWORK. The ACC circuitry manages the timing and DISTRIBUTION of the digital patient data. Hence, it is appropriately named the SERIAL DISTRIBUTION NETWORK.

The SDN is a half-duplex network using terminated shielded twisted pair cable(s) to carry serial digital data. All SDN data is transmitted differentially and serially using block code modulation. Brief explanations of the SDN terms are given below.

Term	Definition
SDN Data	Physiological information such as parameters or waveforms, or non-physiological information such as bed labels, annotation, alarm messages, or time-of-day.
Digital	Using binary logic where a high voltage level is called a one (1) and a low voltage level is called a zero (0).
Serial	A string of ones (1) and zeros (0) in a row create defined words, similar to alphabetic letters used to define known words. However, the SDN words are all the same length. These words are combined to make up messages. Different messages have different lengths.
Half-Duplex	Signals move in one direction at a time over the data wires. Instruments using the SDN never talk and listen at the same time.
Block Coded	A digital coding scheme that facilitates sending serial digital data by insuring not too many ones (1) or zeros (0) are transmitted. Timing information is extracted from the frequent edge transitions (0 to 1, or 1 to 0). This keeps all instruments synchronized while minimizing the bandwidth required.

Term	Definition
Shielded Twisted Pair Custom Cable	A cable containing two wires which carry all digital data on the SDN. The two wires are twisted together to minimize interference from magnetic fields, and encased in a braided shield to limit interference from electrostatic fields. The cable is custom designed with carefully controlled impedance and is well shielded to guarantee noise immunity and ensure system performance. It is necessary to use only Agilent supplied cables in SDN systems.
LAN Unshielded Twisted Pair Category 5	A cable containing four pairs of wires. One pair carries all digital data on the SDN. The wires are twisted together to minimize interference from magnetic fields. UTP, unlike shielded twisted pair, is not encased in a braided shield.
Differential	Two wires carry the same signal, with opposite polarity. These two wires are designated as positive and negative. For a digital one (1), the positive wire is at a high voltage and the negative wire is at a low voltage; vice versa for a digital zero (0). The voltage between these wires (high to low, 1 to 0) is approximately 3 volts (1.5V minimum, 4V maximum).
Termination	In order for differential signals to remain clean, the length of the cable must appear infinite to the circuitry. The cable's impedance is matched by 120 ohms of resistance connected between the two data wires at both ends of the branch (at the ACC and at the instrument). Termination is contained in each instrument.

Logic Convention

Data Wires (SDC or XSDC)

Positive (+) Wire	Pink colored wire
Negative (–) Wire	Blue colored wire
High State (1) (True)	Pink wire potential is positive with respect to blue wire by at least 1.5V
Low State (0) (False)	Pink wire potential is negative with respect to blue wire by at least 1.5V
Positive Transition	Transition from low state to high state
Negative Transition	Transition from high state to low state

SDN Quiescent State	Pink wire biased O.4V more negatively than blue wire. Data wires are quiescent during dead time.

Data Wires (LDC only)

Positive (+) Wire	Pink colored wire
Negative (–) Wire	Blue colored wire

Priority Wires (LDC only)

Positive (+) Wire	Gray colored wire
Negative (–) Wire	Black colored wire
True State	Black wire positive with respect to gray wire
False State	Black wire negative with respect to gray wire

UTP

Positive (+) Wire	Blue wire with white stripe
Negative (–) Wire	White wire with blue stripe
Ground	Green wire

SDN Topology

The SDN uses a star topology that consists of up to 32 individual branches emanating from the center of the star—the ACC. Only one ACC may be used per SDN. One SDN can accommodate up to 24 bedside instruments (one patient per branch), 6 information centers (ICs), and 2 computerized monitoring systems. For details on specific operational and topological limitations, refer to the Installation section.

A typical SDN configuration is illustrated below.

Figure 2-1. Typical SDN Configuration

Applications of SDN Operation

Configurations of the SDN will vary from installation to installation. The SDN is designed to be flexible enough to accommodate a variety of communication needs in the patient monitoring environment, for the present and for future expansion. Many hospitals have more than one care unit. For example, there might be separate care units such as an ICU, a CCU, an MICU, and an SICU. SDN communication between instruments can be customized at installation.

One of the applications on the SDN is the OVERVIEW display. This feature provides a split display screen showing “home bed” and “source bed” patient information. This OVERVIEW mode can be entered either manually for observation or automatically upon patient alarm. Any bed/patient within the same care unit can be displayed in this manner. Softkeys on the monitor are used to form subgroups under the care of each nurse, called care groups, to match nursing assignments. The features of split display screens, message transfer, alarm alert, and care group configuration are all possible using the digital Serial Distribution Network.

In addition, any defined message can be transmitted via serial digital data without requiring any changes to network hardware. There are 63 physiological function codes of which 42 are defined and 21 are reserved for future use. The SDN is flexible enough to accommodate configuration changes at the bedside instrument via plug-in modules without any system modifications, user interaction, or hardware changes. Also, SDN instruments may be disconnected at any time and moved to other system locations and reconnected without bringing the network down.

Another application on the SDN is the TUNING feature at an Information Center. This feature provides the ability to choose which patients/beds are monitored at the IC. Patient information viewed at the IC is displayed in dedicated positions on the display screen called SECTORS.

The sectors may be individually TUNED to any bedside instrument using the softkeys. Any number of ICs may tune to the same patient/bed. The first IC to be tuned to a bedside is called the “primary” IC for that bedside instrument, and furnishes recordings when requested from that bedside. Sectors on other ICs displaying the same bedside information are called “consulting sectors.” All sectors tuned to a given bedside report patient alarms.

Instrument Communication on the SDN

The ACC is the active node of the SDN. It functions to provide the system communications link and to control the data flow, timing, synchronization, and distribution throughout the system. The ACC functions in conjunction with the SDN interface circuitry located within each instrument connected to the SDN. The SDN interface circuitry drives and receives SDN data over the branch cables for instrument-to-system communication via the ACC, and also over the local distribution cable(s) for instrument-to-instrument communication when the local distribution network (LDN) exists.

Only one instrument broadcasts patient data at a time and the ACC rebroadcasts that information from that branch to all other branches on the system. The ACC functions as a rotary switch successively allowing each branch to transmit data to all other branches. The communication system is designed so every instrument gets a chance to transmit all its available data within predetermined cycles. The functional operation and timing sequence of the SDN communication cycle is described below.

SDN Timing Overview

Most information is broadcast by the SDN instruments once every system cycle, or approximately once every second, such as bed labels, derived parameters and time-of- day. Other system information, such as physiological waveform data, is broadcast once every poll cycle or 32 times a second. The ACC controls data communication on the SDN in blocks of time called system cycles. One system cycle lasts 1.024 seconds and is made up of 32 separate poll cycles.

Poll Cycle: One poll cycle lasts 32 milliseconds. Each poll cycle is made up of three distinct segments, which are:

SYNC TAP	4 MS DEAD TIME	TALK TIME

Sync Tap. The sync tap acts as a system synchronization strobe. It is sent by the ACC to all branches (instruments) simultaneously to synchronize the instrument's transceivers and to initiate the beginning of a new poll cycle. The sync tap also contains coded status information.

4 Ms Dead Time. The 4 ms dead time is an enforced quiet time that immediately follows the sync tap.

During the 4 ms dead time each instrument reads data stored by the SDN interface circuitry during the previous poll cycle and stores data to be sent during this poll cycle. This is the only time SDN data can be loaded into and retrieved from the instrument's SDN interface circuitry.

Talk Time. During the talk time a talk tap message is sent to one branch at a time starting with branch 0 to grant permission to talk on the SDN. When a talk tap has been received, the instrument on that branch transmits all of the data stored in its transmit memory. When finished, the ACC senses silence on the branch and sends a talk tap to the next branch. The amount of data transmitted during the talk time varies from branch to branch and changes from poll cycle to poll cycle, so talk taps do not occur in the same place every cycle. After all branches have been polled once, no more data is transferred until the next poll cycle.

Autopoll Mode

In the event that the ACC goes down (loses power, for example), all instruments on the same branch continue to communicate with each other in the autopoll mode. Autopoll means that the first instrument (closest to the wall box) sends sync taps and talk taps to itself and the other instruments on the branch. The timing is exactly the same as normal SDN operation. When the ACC resumes proper operation, the instrument automatically leaves the autopoll mode and returns to SDN communication.

SDN Data Structure — System and Instrument Messages

Digitized information travels serially on the SDN in 12-bit words. These words are grouped together in a string to form complete messages. The SDN uses two types of messages: system messages which originate in the ACC or in the first instrument on branch when in the autopoll mode and instrument messages that originate in the instruments.

System Messages

System messages originate in the ACC. System messages consist of three separate 12-bit words and have the following structure:

FLUSH	SYSTEM DELIMITER	SYSTEM STATUS WORD

Flush: The flush is a unique sequence of 12 bits (101010101010) that are used to clear the line of capacitive charging to ensure reliable detection of logic levels. The flush word always follows any silence on the SDN bus.

System Delimiter: The system delimiter is another unique sequence of 12 bits (100000111111) that are used to help the instruments' transceivers recognize the system message and establish synchronization.

System Status Word: The system status word consists of either a sync tap or a talk tap.

Sync Tap: The sync tap carries encoded information to indicate whether the current poll cycle is the first poll cycle in the system cycle (master poll cycle), to flag “fire axe” and “poll overflow” error conditions (see “SDN Status and Error Conditions” on page 2-12), and to identify the “autopoll” operating mode (see “Autopoll Mode” on page 2-8).

Talk Tap: The talk tap carries encoded information to indicate the branch number and to identify the “autopoll” operating mode.

Note

Since the status information is block encoded, there is not a one-to-one correspondence between status values and bits of the status words. The condition of these bits are indicated on the status LEDs on the ACC and on the display screens of the SDN instruments. See “SDN Status and Error Conditions” on page 2-12.

Instrument Messages

Instrument messages originate in the instrument. These instrument messages comprise of all the data broadcast on the SDN, such as waveforms, derived parameters, alarm status, text messages, bed labels, time-of-day, and many others. Instrument messages vary in length (i.e., number of words) but always consist of the following structure.

INSTRUMENT DELIMITER	HEADER	BODY	INSTRUMENT DELIMETER

Instrument Delimiter: The instrument delimiter is a unique 12-bit word (110010011111) used to mark the beginning and the end of the message.

Header: The header is always four words long (48 bits) and is used to label the content of the message body. The second word is called the “signature.” Listening instruments examine the signature to determine whether they want to capture this message.

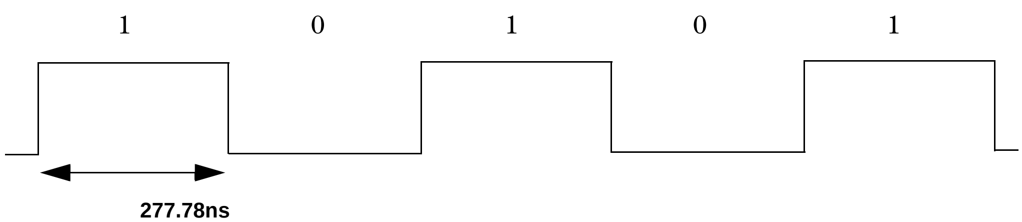
Body: The body of the instrument message contains the actual data. The number of data words in the body depends upon the type of message being sent.

SDN Normal Operation

This section contains the SDN data timing specifications and a description of the instrument status message.

SDN Data Timing Specifications

During normal operation SDN digital data travels on the SDN at 3.6 Mbit; the bit cell width is 1/3,600,000 seconds, or 277.78 ns.



Bit Cell Width

Therefore, the 12-bit word is 3.33 µs long. One poll cycle lasts 32 ms, but not all of this time is available to transmit data. Considering all of the overhead time (see breakdown below), approximately 7700 words of data can be transmitted in every poll cycle. Overhead time consists of the following:

a. Sync tap (10µs)

b. Dead time (4 ms)

c. Time to listen for activity on each branch before sending a talk tap (3.33 µs per branch)

d. Talk taps (10µs per branch)

e. Time to listen for silence before going on to the next branch (12.22 µs per branch)

f. Headers and delimiters in messages

Instrument Status Message

Once every system cycle (approximately once a second) each instrument connected to the SDN broadcasts a message called the Instrument Status Message. The content of this message allows all other instruments to identify its operational status. Contained in every Instrument Status Message are the following:

a. Instrument Identification: Each instrument can be identified as any SDN bedside monitor, IC, or computer. For bedsides the instrument identification gives branch number and type of bedside monitor.

b. SDN Communication Error Flags: A variety of SDN system errors are identified and flagged in the instrument status message. Refer to the Troubleshooting section for details on the network test and SDN system troubleshooting.

c. Status Indicators: Three unique status indicators reflect the instrument's ability to communicate on the SDN. The three status indicator bits in the instrument status message are described below.

Each bit can have a value of 0 or 1. In normal operation the status indicator bits are set to 1.

SDN/Autopoll

The normal operating mode is SDN. The ACC's sync tap indicates to the instruments that they are in the SDN mode. If operation of the ACC fails (loses power for example), then one instrument on each branch generates its own sync taps and talk taps that it sends to itself and to the other instruments on that branch. Thus, the local communication is maintained. The locally generated sync tap indicates to the instruments on that branch that the branch is operating in Autopoll mode.

If the ACC becomes active again, then the branch automatically returns to the SDN mode.

ONLINE/OFFLINE

The normal operating mode is ONLINE. The ONLINE status indicates that an instrument has examined itself and is ready and able to operate reliably on the SDN. At power up an instrument is OFFLINE. When it successfully completes its own initialization it may put itself in the ONLINE state.

NETWORK/LOCAL

The normal operating mode is NETWORK. The NETWORK status indicates that an instrument is synchronized with the system cycle. This is important because most of the data on the SDN is sent only once each system cycle, during a specific poll cycle. An instrument must synchronize with the master poll cycle in order to know when to transmit specific data. At power up an instrument is in LOCAL mode and starts searching for the beginning of a system cycle. As soon as a valid system cycle has been found, the instrument may set itself in NETWORK mode.

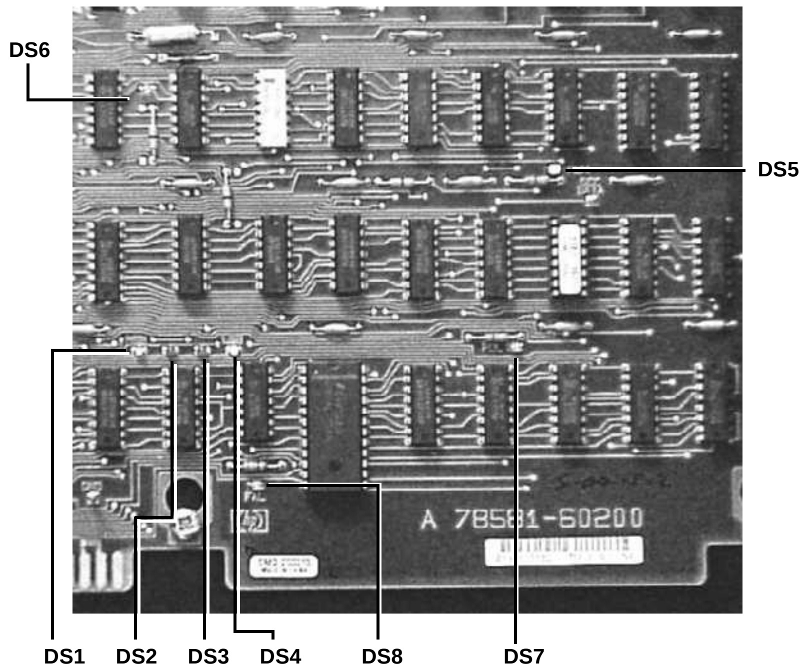
SDN Status and Error Conditions

SDN system status and error conditions can be viewed on the IC display, bedside, and indicated on the ACC via LED status and error code indicators. A detailed description of the SDN system errors is described in the SDN troubleshooting section.

ACC Error Conditions — SDN Failure Detection

The functional operation of the ACC can be checked and verified to ensure reliable operation. During normal operation, the following LEDs on the Control/Driver PC board are illuminated continuously:

RED DS1	(MSB) flickers
RED DS4	(LSB)
GREEN DS5	(RUN)
RED DS6	(Ti)



The ACC is designed to detect and isolate certain fault conditions which may be present on the SDN bus.

Fire Axe: One type of fault condition that could occur is the presence of activity on a branch which has not yet been sent a talk tap. The ACC senses the branch for 3.3 µs before sending a talk tap message. If activity is detected during this time, then no talk tap is sent and the ACC skips over that branch automatically and cuts it off from the rest of the SDN. This condition is called “fire axe”, and is indicated at the ACC by illuminating the yellow fire axe LED DS8. However, if no activity is detected on a branch, the ACC checks to ensure that the SDN bus is biased correctly (in the low state). If the bias is correct, a talk tap is issued. Otherwise, the branch is fire axed.

Poll Cycle Overflow: Another fault condition detected by the ACC is a poll cycle overflow condition. The yellow poll cycle LED DS7 is illuminated signifying a poll cycle has overflowed if, before the next sync tap, all 32 branches do not receive a talk tap and an opportunity to transmit all their data.

ACC Theory of Operation

The ACC consists of three PC boards (refer to Figure 2-2):

- Main PCB
- Transition board assembly
- Power supply

Main PCB (78581-60200)

The Main PCB is considered the control/drive board. It connects up to 32 branch cables via the Transition Board to provide timed multiplexed communication links and system synchronization. The circuitry on the PCB sets up a polling cycle that allows each branch access to the SDN bus in a sequential manner. Data coming in from one branch is received and then “broadcast” simultaneously to the remaining branches of the SDN. As each branch transmits in sequence, the SCC buffers, retimes, and retransmits the data.

System communications is controlled, timed, and synchronized by the ACC issuing regular system sync messages every 32 milliseconds and a master sync message every second.

When power is supplied, the MODE switch is sensed for normal operation. The ACC then issues a SYNC TAP message to all branches connected to the ACC. The ACC senses the poll timer for 4 ms elapsed time to allow the instruments to unload their receive buffers and load their transmit buffers. Then, branch 0 is set up for a TALK TAP message by first sensing the branch for activity and line state (polarity 1 or 0). If activity is sensed within a 2.7 microsecond window, or the line is in the logic 1 state, then the branch is considered faulty (FIRE AXE condition) and is skipped over without a TALK TAP being issued. However, if no activity is sensed, a TALK TAP message is transmitted out the branch in which the branch number is embedded. The branch number is a 6-bit block encoded word derived from the Block Code ROM. The 5-bit branch binary counter is the ROM address pointer.

After the TALK TAP message has been transmitted, the ACC turns around the line drivers and receivers and senses for activity from branch 0 and, also, turns on the “broadcast” to all remaining branches. The ACC senses for transmission activity for 12.2 microseconds and will timeout and switch to the next branch if no activity is sensed. Activity is defined as one or more positive transitions trapped within the 12.2 microsecond window.

The ACC senses the end-of-transmission by detecting 12.2 microseconds of continuous silence; no positive transitions for example. The next branch in sequence is then sensed for silence (no activity) and issued a TALK TAP message in the same manner. Each branch is polled sequentially until all 32 branches have been issued a TALK TAP message. The last branch polled at the end of 32 milliseconds must be branch 31 for TALK TAP messages. If not, the poll cycle is in error and an error flag is set in the next SYNC TAP message to indicate a POLL OVERLFOW; for example, system overload or poll sync loss.

Transition Board (78581-61253)

This PCB interfaces from the RJ45 connector to the main PCB. There are 32 ports label from 0 through 31. Port 0 is the master time port for the central stations. Ports 1 through 24 are bedside ports. Ports 25 through 31 are for other central stations, computers, or mainframes. The transition board supplies the input/output data from the bedside to and from other devices.

Power Supply (M2604-60002)

This is a 5V automatic switch power supply. It supplies power for the main PCB, power on LED and the 5V indicator LED on the rear of the power supply board.

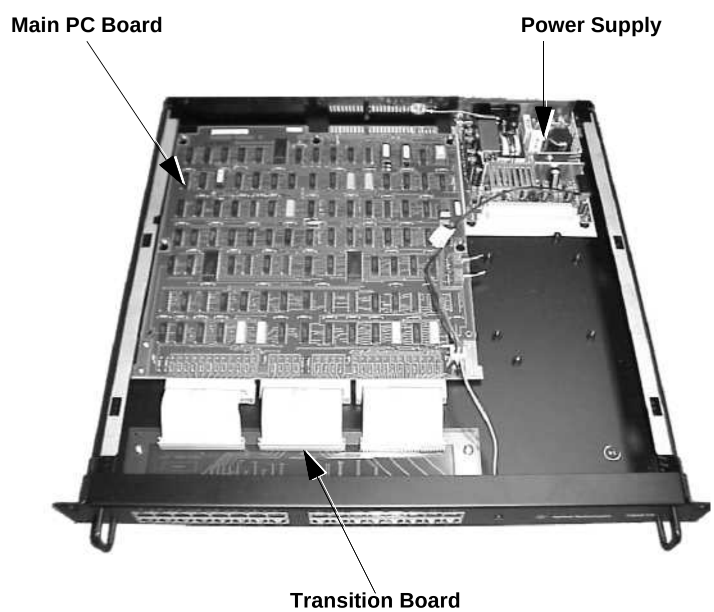


Figure 2-2. Internal Components of the ACC

Section 3: SDN and ACC System Level Troubleshooting

Caution **Service and repair of the SDN system components is to be performed by authorized service personnel only.**

SDN Troubleshooting Overview

This section describes a logical approach for service personnel to diagnose and identify the source of an SDN system problem and to isolate the problem to the instrument/cable level for service and/or repair. The troubleshooting procedures are presented simply and logically, and should be followed in the sequence indicated.

The following troubleshooting procedures are written to minimize disturbance to system patient monitoring and to avoid (and to determine the need for) bringing down the entire SDN communications system.

When troubleshooting a new SDN system installation (not a patient connected SDN system), it may be more expedient to power down the ACC in order to checkout the cables and swap the Control/Driver PC board in the ACC. Discretion must be applied according to the constraints of the situation.

The content of this text presumes that the service person is familiar with Agilent monitoring instrumentation and has a basic understanding of the SDN system operation, specifically:

- SDN Architecture and Topology
- Agilent CareNet Controller
- Structure of System Cycle and Poll Cycle
- SDN Status
  - Autopoll/SDN
  - Offline/Online
  - Local/Network
- SDN Interface Board — Functional Block Level
  - Activity Detection, Autopoll Enable
  - Priority Wires (Upstream/Downstream)
  - Last Box Detection, Termination

In addition, service personnel must be aware of the structure of the SDN system being troubleshot with respect to:

- Care Units
- Bed Label/Branch Assignments
- IC Tuning
- IC/Branch Assignments

The following abbreviations are used throughout this section:

- BS — Bedside Monitor
- CS — Central Station
- LDC — Local Distribution Cable
- LDN — Local Distribution Network
- M/T — Monitor/Terminal; an SDN Bedside
- NT — Network Test
- IC — Information Center
- ACC — Agilent CareNet Controller
- SDC — System Distribution Cable
- XSDC — Extended System Distribution cable
- SDN — Serial Distribution Network
- SDNIF — SDN Interface

A simplified block diagram of the SDN system components is shown in the following:

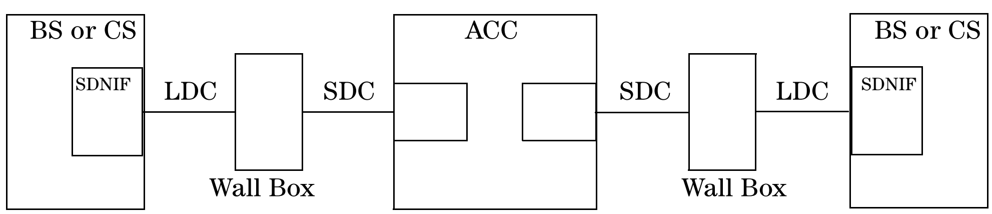


Figure 3-1. SDN Components—Simplified Block Diagram

Troubleshooting Resources, Tools, and Equipment

The following resources are available with the SDN instruments to facilitate troubleshooting the SDN system:

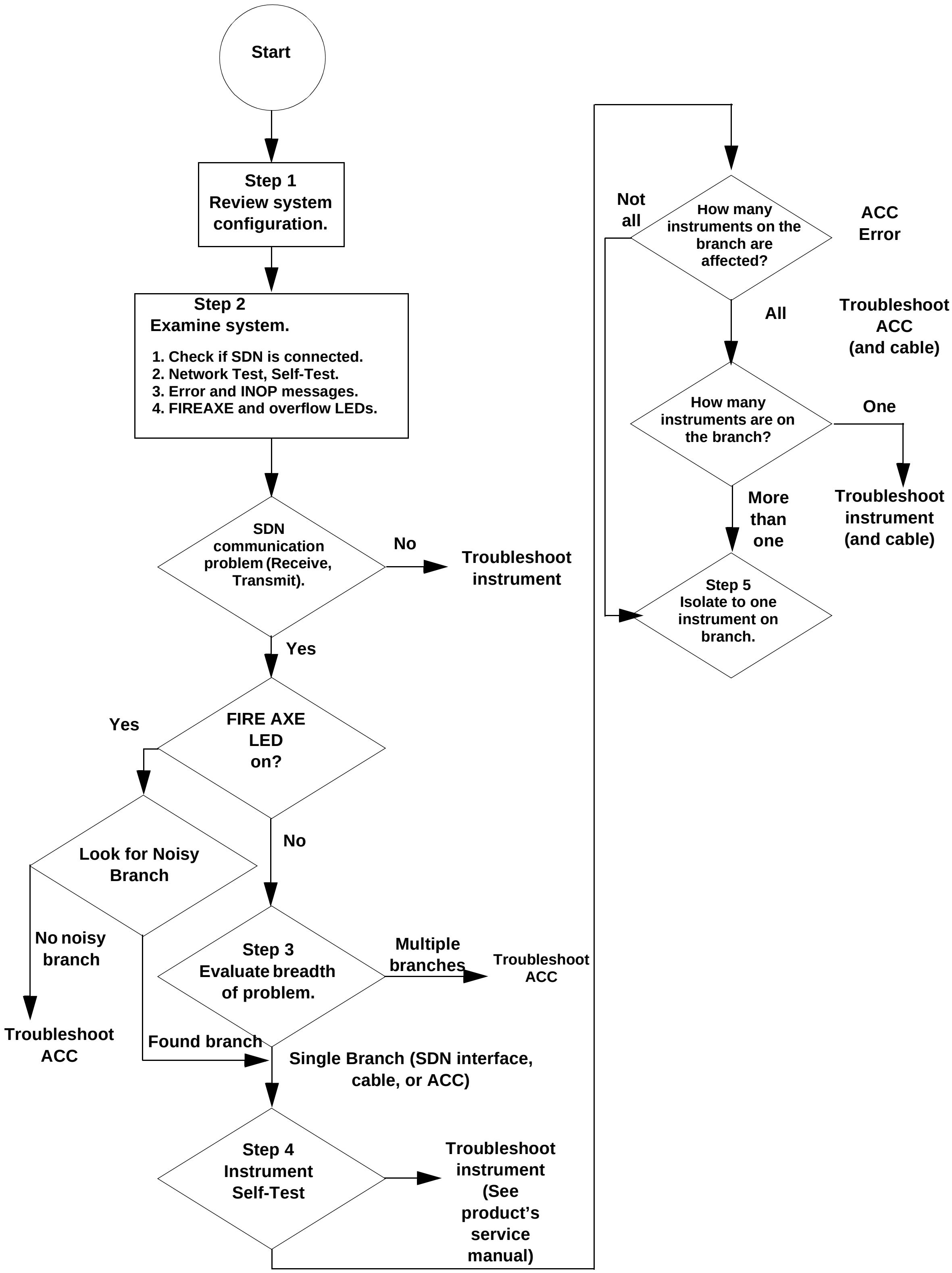
- INOP Messages
- Overview Function
- Network Test
- Self-Test Routines
- Error Codes
- Instrument Service Manuals

A flat blade screwdriver and a 50-foot LDC are recommended when troubleshooting the components of the SDN system.

SDN Troubleshooting Flowchart

The SDN troubleshooting steps are outlined in a simplified SDN system troubleshooting flowchart illustrated on page 3-4. Follow the steps indicated in the sequence shown. Until you are familiar with the troubleshooting flowchart procedure, refer to the detailed troubleshooting procedures referenced for each step.

Figure 3-2. SDN System Troubleshooting Flowchart



STEP #1: Review Customer's System Configuration

Obtain a basic understanding of the customer's system architecture and topology, and familiarize yourself with the SDN configuration.

Review the instrument branch assignments, care unit definitions, and IC tuning ranges. Pay particular attention to the configuration of bedsides: to which IC they are hard-wired, and where they are being monitored. Review the configuration of IC groups.

If the system configuration documentation is not available, use the branch number assignment label located inside the ACC and the Network Test to review the SDN system configuration.

STEP #2: Examine System and Gather Symptoms

An instrument using the SDN such as IC or bedside is more likely to be the source of a problem than the SDN hardware such as the interconnecting cables or the ACC. With this in mind, start by looking for the obvious product malfunctions. To do this, use the resources available and evaluate the results.

- Assure that the instrument is SDN connected.
- Examine INOP messages and error codes.
- Check FIRE AXE and OVERFLOW LEDs in the ACC.

SDN Connections

Evaluate the results of the resources listed above to determine if there is an SDN or non-SDN problem before continuing with this procedure.

SDN Error Messages and Error Codes

The following messages can be found at the bedside, the central station, or the telemetry mainframe.

Table 3-1: SDN Error Messages

SDN Error Messages	Description
SDN COMM FAILURE — DUPLICATE BED	Indicates there is another bed on the system using the same bed number as this bed. No data is transmitted on SDN. Message appears at top of screen.
SDN COMM FAILURE — ILLEGAL BED NUMBER	Indicates this bed is not connected to a branch in the range #1 through #24. No data is transmitted on SDN. Message appears at the top of the screen.
SDN EQUIP MALF	Indicates disruption to SDN communication. Problem may be in this instrument or in SDN.

Table 3-1: SDN Error Messages (Continued)

SDN Error Messages	Description
NO OVERVIEW FUNCTIONS AVAILABLE	Monitor/terminal is not connected to the SDN, or it is getting no signals from the ACC; i.e., it is operating in the Autopoll mode.
NO DATA FROM BEDS IN UNIT	In this Care Unit there are no beds in the same group as this bed and no beds in the All Beds Care group.
NO DATA FROM BED	A bed which was currently being viewed in the OVERVIEW section of the screen has stopped communicating on the SDN. The message remains until the bed returns or display is cleared with the CLEAR hard key or until NEXTBED softkey is used to view another bed. Indicates discontinued or cut off data. Displayed in sector(s) for which no data is available—in inverse video. If the patient has been moved or discharged, there are several ways to clear this message. Tune the sector to a different bed in the system using SETUP and NEW BED keys. A new bed label, waveform data, etc., will appear if the new bed is active on the network.
NO RECORDER AVAILABLE	This message appears when either stored waveform or real time waveform recordings are requested if IC recorder is out of paper or its door is open (IC message CHECK PAPER/ DOOR RECORDER #_____ or NO RECORDER ON LINE). This message appears for any record request (stored, real time, or delayed) if the M/T is in the Autopoll mode or if there is no primary monitoring IC for this bedside.

Diagnose the Problem as SDN or Non-SDN

Using the symptoms and information gathered in the previous steps, diagnose and isolate the problem as a malfunction of a specific product or a problem with the SDN system communication.

Some SDN and non-SDN product related symptoms are listed below.

Noisy Branch

1. Remove each RJ45 connector one at a time to determine which is the noisy branch.

2. Check the FIRE AXE LED to see if it is still lit and then replace the RJ45 connector.
3. Check the next branch.

SDN and Non-SDN Related Problems

Refer to the following table for SDN and non-SDN related problems.

SDN Related Problems	Non-SDN Related Problems
• Instrument missing on Network Test • Wrong status code for instrument on Network Test • SDN Error Codes: 0 - - - 8 - - - Monitor/ Terminal 5- - - D- - - IC	• Instrument not SDN connected • *Product error codes, but none of which are 0 - - - 8 - - - Monitor/Terminal 5- - - D- - - IC
*If SDN error codes and non-SDN error codes occur, both subsystems must be considered	
• Loss of data from one SDN instrument to another • OVERFLOW or FIRE AXE LED illuminated in the ACC	• Loss of data at its source

Action

- If a product malfunction has been clearly identified, then troubleshoot that product (or non-SDN subsystem, such as an IC and recorder) according to the troubleshooting procedures specified in the associated product's service manual.

Note It is highly recommended that the instrument(s) be disconnected from the SDN during troubleshooting. SDN connections between ICs should be disconnected when troubleshooting one IC in an IC group if the others are remaining connected to the network.

- If the FIRE AXE LED in the ACC is illuminated or flickering, look for a noisy branch. See "Cable Verification Procedures" on page 3-13.
- If SDN communication errors are indicated, and if no specific product is immediately identified, then go to "STEP #3: Evaluate the Breadth of the Problem" on page 3-8.

STEP #3: Evaluate the Breadth of the Problem

Decide whether this is a single branch problem or a multiple branch problem. Find out how many branches are unable to communicate properly on the SDN; how many branches are unable to receive data from any other instrument and/or unable to transmit data to any other instrument.

Test the reception of the bedside with the OVERVIEW mode or with the NETWORKTEST. Test the reception of ICs under normal monitoring.

Test the transmission of the bedside with the NETWORK TEST at another bedside or with the OVERVIEW mode at another bedside.

If multiple instruments were missing from the NETWORK TEST display (STEP #2) or gave status codes other than 001 C normal operation or 0030 self-test, then a multiple branch problem is indicated.

Action

- If more than one branch cannot receive at all or transmit at all, then troubleshoot the ACC. Refer to the ACC Troubleshooting section.

  Other possible sources of multiple branch problems (lower probability) are given on page 3-12.

- If only 1 branch cannot receive at all or transmit at all, then go to STEP #4.

  Other possible sources of single branch problems (lower probability) are given on page 3-12.

STEP #4: Self-Test Check of SDN Interface Circuitry

The problem has now been isolated to a system communication problem on one branch. The problem could reside in the SDN interface board, SDN cabling, or branch specific circuitry in the ACC. Refer to Figure 3-3.

Note

The SDN interface residing in the bedside/mainframe or IC is more likely to be the cause of the problem than the branch specific circuitry in the ACC. Each instrument's self-test routine checks a portion of its own SDN interface circuitry (SIC chip, buffer RAM, signature RAM).

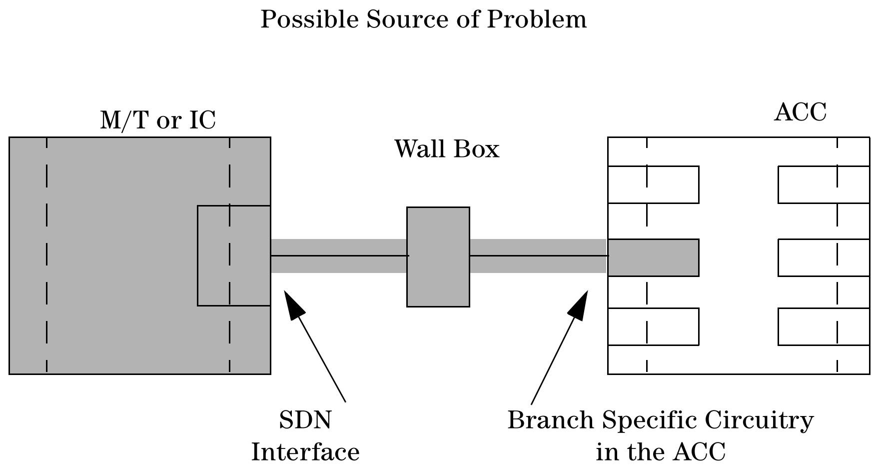


Figure 3-3. SDN Interface Problem Area

If not already done, run the instrument's self-test on each SDN instrument on the faulty branch.

Refer to instrument's service manual for details. Some codes identify faulty instrument circuitry.

If an instrument malfunction is indicated, troubleshoot that product's SDN interface according to the instructions described in the associated product's service manual.

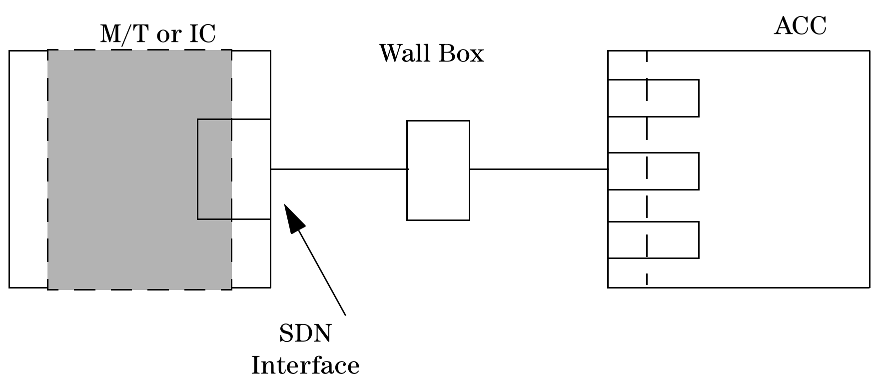


Figure 3-4. SDN Instrument Malfunction

If no specific instrument malfunction is indicated, refer to the following figure:

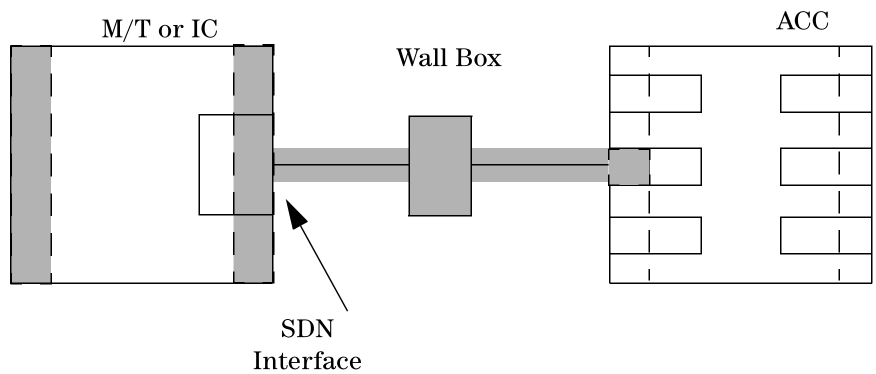


Figure 3-5. SDN Non-Instrument Malfunction

- If the problem affects only one instrument or all the instruments on the branch, go to STEP #5.
- If the problem does not affect all instruments on the branch, it can be concluded that the ACC and cabling running up to, but not including the last “good” instrument, are functioning properly. Go to STEP #5.

The problem is located in one of the following places:

a. SDN Interface PC Board (drivers, receivers and relays and other circuitry were not tested in instrument’s self-test routine).

b. ACC (components which are branch-specific)

c. Cables/Connectors (LDC, wall box, SDC, connection to ACC)

In order to verify which part of the branch is faulty, it is now necessary to swap the branch with a known good branch:

At ACC, disconnect RJ45 connectors and jump wires to an unused branch.

Caution

CAUTION — Ability to view swapped monitor/terminal:

- If the “unused branch” is not in the same Unit (e.g., same ICU) as the former branch, then it cannot be viewed in OVERVIEW mode. Unused bedside branches will be in Care Unit 1 if default values were programmed in the IC(s) at installation.
- If the “unused branch” is outside the tuning range of the IC, then it cannot be viewed at that IC.

Warning

Warning — Reconnection Warning — Disconnect SDN patient before swapping:

Disconnect the patient from the monitor/terminal before swapping branches in the ACC.

EXTEND TEST mode can be used to generate waveforms for verification.

Caution

CAUTION — Disconnection Caution — Data will be missed:

- While a monitor/terminal is disconnected, no alarms are available from that monitor/terminal at the IC or at any other monitor/ terminal in the OVERVIEW mode.
- While an IC is disconnected, it generates no alarms or alarm recordings.

Caution

CAUTION — Use Appropriate Unused Branch Number:

- For a monitor/terminal, the “unused branch” must be branch #1 through #24. Make sure that the “unused branch” does not have a telemetry bedside assigned to it.

  If a monitor/terminal is placed on branches #0 or #25 through #31, the message “SDN COMMUNICATION ERROR — ILLEGAL BED NUMBER” will be displayed. The bedside will be able to receive data, but will not be able to transmit data.
- For an IC, the “unused branch” must be branch #0 or #25 through #31.

  Make sure that the “unused branch” does not have a telemetry bedside assigned to it.

STEP #5: Isolating a Problem on A Local Distribution Network (LDN) With Two or More Instruments

The problem has been isolated to one of the SDN interface boards, or to one of the LDC or system distribution cables (SDC or XSDC).

A problem on the LDN might affect any number of instruments on the branch.

A problem in one SDN interface might affect other instruments on that branch without impairing its own function on the SDN.

Miscellaneous Items

The preceding troubleshooting procedures provide a general methodology which captures the majority of electronic hardware failures. However, several problems can be identified which will not be caught, and are elaborated below.

a. Cable checking was not always explicitly stated as a possible problem source. However, cables should be checked for continuity and shorts when suspect using the cable verification procedure specified on page 3-13.

   Cable intermittents: Moving cables with intermittent connections can cause symptoms to disappear or reappear unpredictably.

b. Excessive noise on one branch can impair communications on all branches. This can occur if a raw cable with no wall box connector is wired to the ACC and the raw ends are shorting to each other or to conduit. This can also occur if the wall box connections are loose or LDCs are loosely connected. The FIRE AXE LED will usually be illuminated. Instruments may disappear and reappear on the Network Test, or their status may change from 001 C. Noisy branches can be identified by low voltage levels below ground and high levels above 5V. Proceed with cable verification procedure specified on page 3-13.

c. Hospital ground may not meet the system specification. If this is suspected, refer to the ground check procedure on page 3-13.

d. The hospital has installed cables (other than Agilent Technologies SDN or Agilent Technologies Analog cables) in violation of Agilent Technologies distance and shielding specifications. The new cables are causing interference.

e. Overloaded system — Constant or intermittent overflow: In an overloaded system some branch will be transmitting at the end of the 32 ms poll cycle. All higher numbered branches get no chance to transmit. The OVERFLOW LED will be illuminated or flickering in the ACC. True chronic overflow is highly improbable with the current set of products in a fully loaded system (24 monitor/terminals, 6 ICs, and PDMS).

Recap of Troubleshooting Procedures:

STEP #1: Review System Architecture

STEP #2: Examine System — gather symptoms

- Determine if the problem involves SDN connected equipment
- Error codes and INOPs
- ACC LEDs

STEP #3: Run Network Test: Evaluate breadth of problem (more than one branch = ACC problem)

STEP #4: One branch: run instrument self-test to check SDN interface and isolate to ACC or local distribution network

STEP #5: Isolate to one instrument on Local Distribution Network

Reverification Instructions

Three forms of communication should be verified: reception, transmission, and interactive protocol.

a. Reception.

   To verify the monitor in a care unit with other beds, put it in a Care Group with them and view beds in OVERVIEW mode. Show the bed roster to verify the new bed label corresponding with the current branch.

b. Transmission.

   Run the Network Test on an (unswapped) monitor/terminal. The Network Test determines whether instruments in the swapped configuration are active on the SDN and are able to transmit the proper instrument status message. The Network Test shows all instruments on the system except the instrument displaying the test, regardless of Care Unit definition or IC tuning limits.

   To verify the monitor/terminal: View this bed at another monitor/terminal or at an IC.

   To verify an IC: View hard-wired telemetry bedside monitors on a monitor/terminal in the OVERVIEW mode or view the Network Test on a monitor/terminal.

c. Interactive Protocol.

   To verify the monitor/terminal: Request a real time recording from the monitor/terminal to the IC.

   To verify the IC: Request a real time recording from any bedside connected to that IC.

Cable Verification Procedures

Cable check procedures are appropriate in the following situations:

- New system installation cable verification
- Upgrades to existing SDN system involving new branches
- SDN Troubleshooting
- When a cable is suspected to be faulty
- When the FIRE AXE LED is illuminated in ACC
- Reverification after repair of cable problem

These procedures address the following problems:

- Hardware problems
- Shorts in data wires and priority wires
- Opens in data wires and priority wires
- Miswiring
- Voltage levels (ACC drivers)
- Cable identification
- Ground checking

Hardware Problems

The cable verification procedures for hardware problems are separated into two steps.

The first step is performed at the ACC end of the branch and is used to verify the functional operation of the ACC drivers and the absence of shorts in the data wires.

The second step is performed at the SDN instrument end of the branch (IC or monitor/terminal) and identifies opens in the data wires and verifies proper operation of priority wires. Miswiring of blue and pink data wires is evident. This procedure is valid whether or not instruments are connected to the branches. Refer to the following section.

Verify Instrument End of the Branch Cable

Check for opens between the ACC and instrument

a. Disconnect the local distribution cable (LDC) from the wall box connector and from the instrument.

   Using a digital multimeter, check the LDC for continuity, opens and shorts.

b. If no problem is found with the LDC, power down the ACC—see page 4-1.

c. Measure the resistance of the system distribution cable at the instrument end as follows. Refer to connector pin illustrations shown in Figure 3-6.

   PIN A(+) — — to — — PIN E(–) = 120 Ohms (+11 Ohms; - 5 Ohms)

   PIN A(±) — — to — — PIN D (GND) = ∞

   PIN E(-) — — to — — PIN D (GND) = ∞

Verify Proper Operation of Priority Wires

With the ACC running and the instruments connected to the branch, measure the priority wire voltage from the downstream connector on the last instrument—most downstream instrument—on the branch as indicated on the following connector pins. Refer to the connector pin illustrations shown in Figure 3-6.

MEASUREMENT	NOMINAL VOLTAGE MEASURED WITH DVM
PIN C (±)—–to—–PIN B (–)	= ≥3.0V
PIN C (±)—–to—–PIN D (GND)	= ≥0.6V
PIN B (–)—–to—–PIN D (GND)	= ≥3.6V
PIN C (+)—–to—–PIN A or PIN E	= ∞
PIN B (–)—–to—–PIN A or PIN E	= ∞

SDN Bedside:

PIN A (±)	---------------->	DATA WIRE — PINK (positive)
PIN B (–)	---------------->	PRIORITY WIRE — BLACK (negative)
PIN C (+)	---------------->	PRIORITY WIRE — GRAY (positive)
PIN D (GND)	---------------->	DRAIN WIRES — GROUND
PIN E (–)	---------------->	DATA WIRE — BLUE (negative)

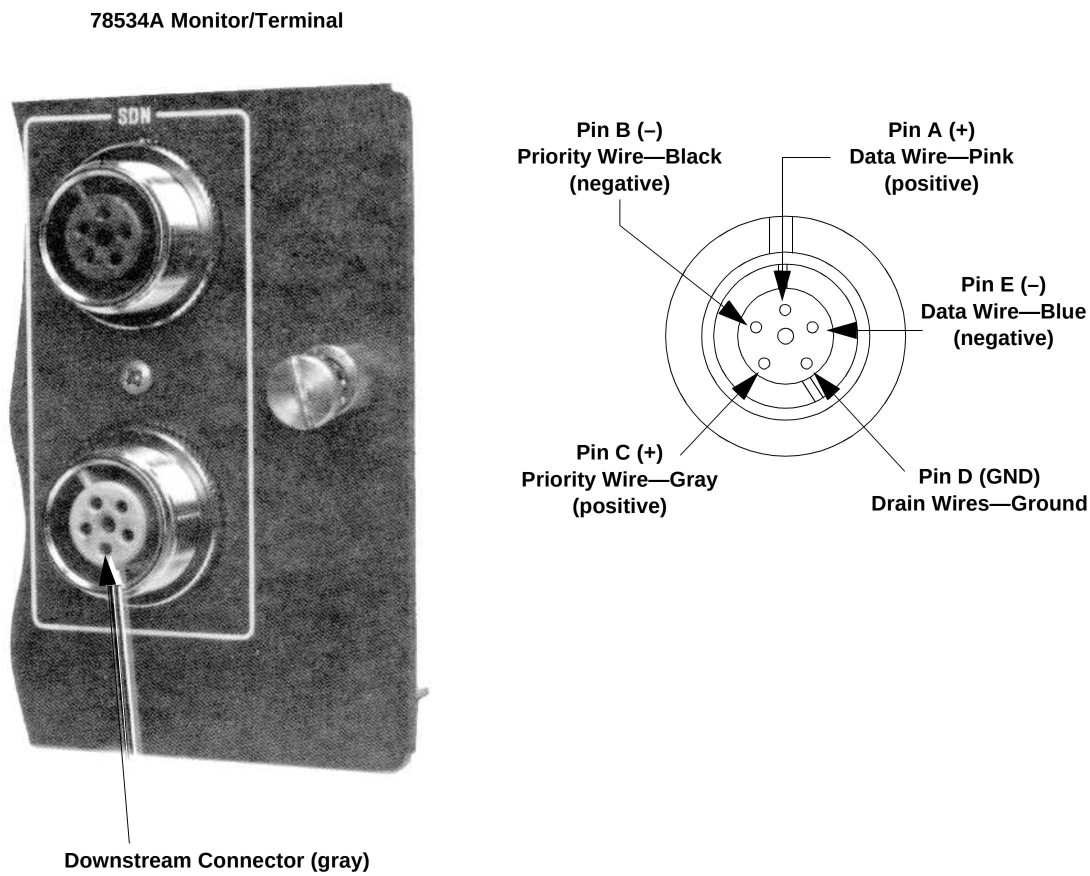


Figure 3-6. SDN Downstream Connector Gray

Ground Check Procedure

The maximum ground potential difference between the third wire ground delivered to an ACC and the third wire ground delivered to any of its SDN instruments, with the SDN cables disconnected, is 500 mV RMS.

The following check will usually indicate if a grounding problem exists on a given branch without taking the whole system down.

a. At the end of the branch cable in question turn off and unplug the instruments using that branch.

b. Measure the voltage between the ground coming through the SDN wall box and the third wire ground of each instrument’s wall outlet. The value measured on an voltmeter must not exceed 500 mV RMS.

Section 4: ACC Maintenance

ACC Maintenance

The Agilent CareNet Controller (ACC) is a ROM-driven microprogrammed state machine self-contained on the Control/Driver PC board for ease of serviceability.

Once installed and running properly, the ACC requires virtually no periodic maintenance or servicing. However, when an electrical problem is evident within the ACC, isolation of the problem and repair can be accomplished using the troubleshooting procedures and self-test routines listed in Section 3: SDN and ACC System Level Troubleshooting.

Caution **Ground wrist strap must be worn and grounded to the ACC chassis.**

ACC Failure, Power Up, and Power Down Procedures

When the ACC has to be powered down for service or during a power failure, the system communications is interrupted. If any of the branches have more than one instrument daisy-chained on that branch, the local distribution network (LDN) takes over and allows the daisy-chained instruments to communicate with each other in the autopoll mode. When power is cut off to the ACC, the following occurs to the instruments connected to the SDN branches:

Bedside Nothing perceptible happens. The monitor goes into the autopoll mode automatically, but nothing happens to the wave forms. When attempting to enter the OVERVIEW mode or OVERVIEW SETUP mode, the monitor displays the message NO OVERVIEW FUNCTION AVAILABLE. When power is restored to the ACC, the bedside display blanks for a couple of seconds, and then resumes SDN communications.

Information Center (IC) All sectors will display “No Data From Bed.”

When power is restored to the ACC, the SDN bedsides that were blanked now reappear at the IC.

Section 5: Parts List

Part Numbers

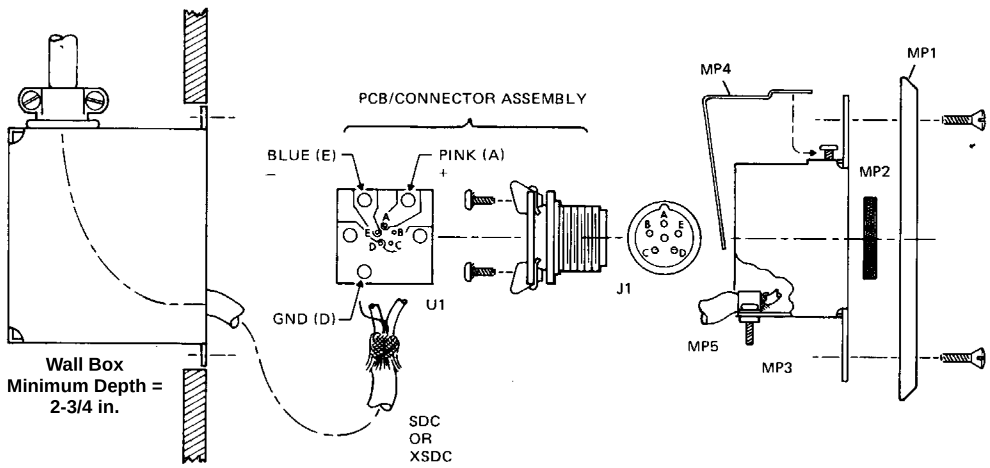


Figure 5-1. SDN Faceplate/Connector Kits-Component Locations (78599AI-J01, JO2, and J53)

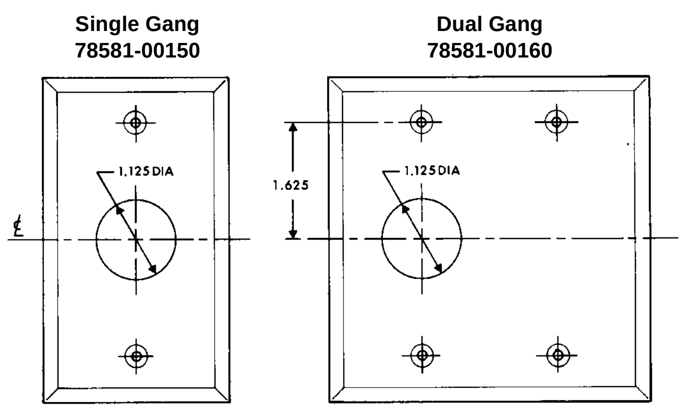


Figure 5-2. SDN Faceplates, Single- or Dual-Gang

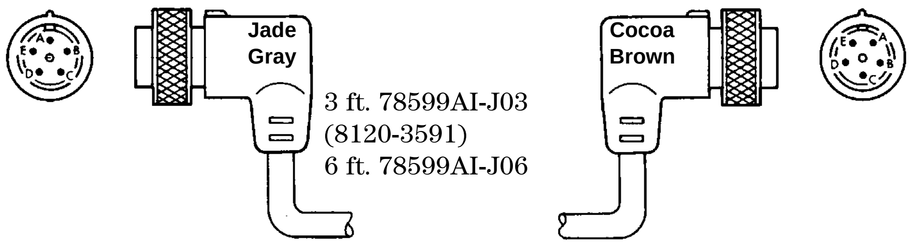


Figure 5-3. Standard Length Local Distribution Cables (LDC)

Figure 5-4. Power Supply Assembly (M2604-60002)

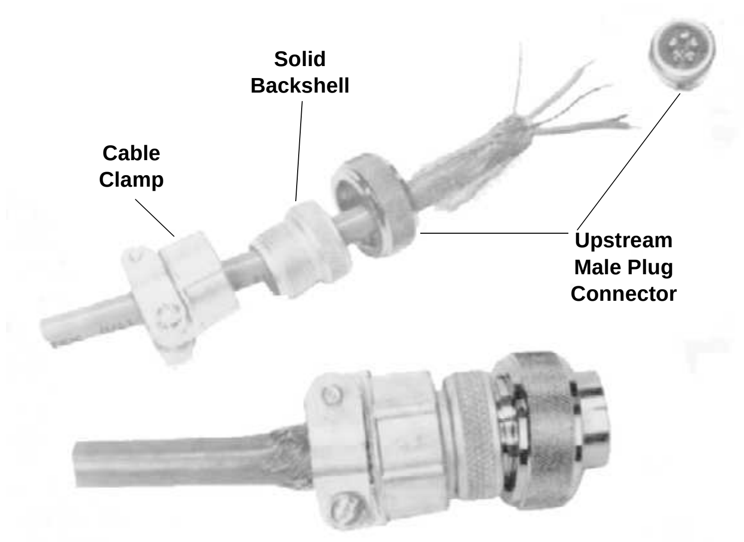


Figure 5-5. Variable Length LDC Kit (78599A-J50)

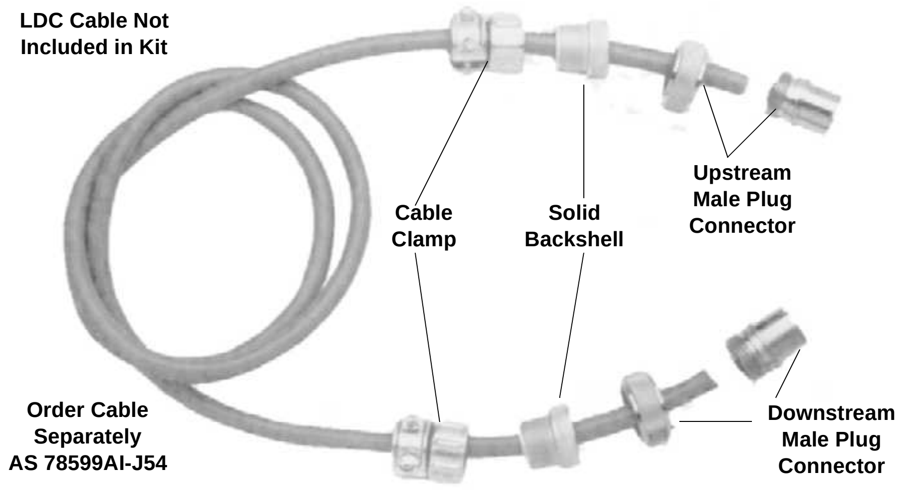


Figure 5-6. Connector LDC Kit (78599AI-J52)

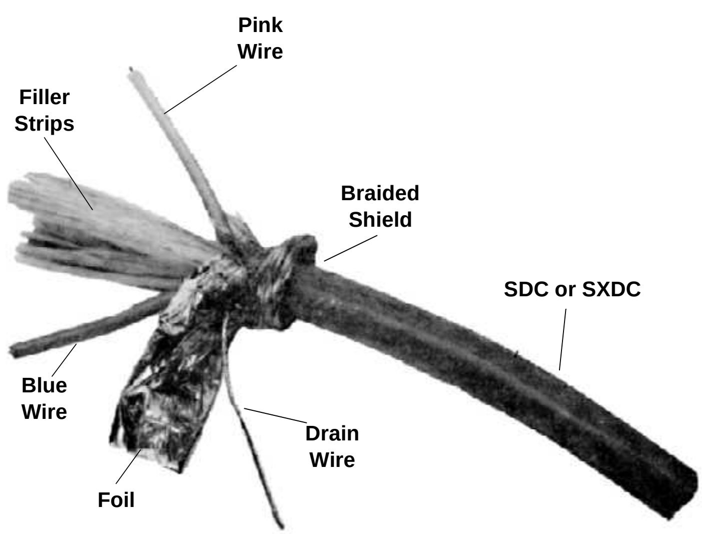


Figure 5-7. SDC and XSDC System Distribution Cables

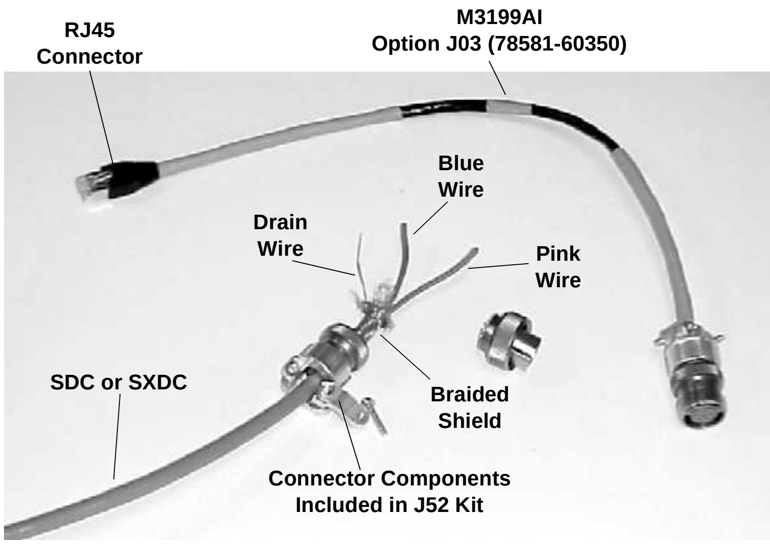


Figure 5-8. SDC and XSDC System Distribution Cables with M3199AI Option J03 for Runs Longer than Allowed with UTP Cable

Part Number	Description
78581-68200	Main PCB
78581-61253	Transition board assembly
M2604-60002	Power supply
78581-61257	Wall mount
78581-61080	Second ground wire
78581-61251	Cover assembly
78581-61250	Chassis assembly
78581-61256	LED cable assembly
78581-60350	RJ45 to SDN cable
78581-61254	Transition board cable
78581-61255	Power cable assembly
2110-0454	Pico fuse, 7A (Main PCB)

Section 6: Component Installation and Disassembly Procedures

Overview

The Serial Distribution Network (SDN) consists of an Agilent CareNet Controller (ACC) with up to 32 signal distribution cables (branch cables) emanating from it to each wall box, the connectors, switch wall boxes, and local distribution cables that interconnect the wall box to the instruments. The essential parts used to interconnect the SDN system components are illustrated in Figure 6-1 on page 6-2. See “Parts List” on page 5-1 for a complete listing of SDN and ACC parts, and specifications.

Caution **Cables and parts supplied by Agilent Technologies, Inc. must be used in the installation of the SDN system, or the warranty may be void.**

This installation section describes the site preparation and installation responsibilities as well as the detailed installation instructions for installing the parts of the SDN. An overview of the SDN and ACC installation, system communication verification procedures, and the recommended installation sequence to follow is given on page 7-8.

Within certain limitations, various combinations of bedside monitors and central station displays may be connected to the SDN via branch cables. The instruments connected to the SDN are ordered separately from the SDN components. The installation requirements for these instruments are outlined in detail in separate documents. Refer to the associated instrument’s service manual.

Typical SDN System Interconnecting Parts

Examples of typical SDN system configurations are illustrated at the beginning of this document. Although the number of branch cables and the types of instruments used may vary per the installation, the component parts used to interconnect the SDN system are illustrated in Figure 6-1. See “Parts List” on page 5-1 for a complete listing of SDN and ACC parts, options, and installation kits.

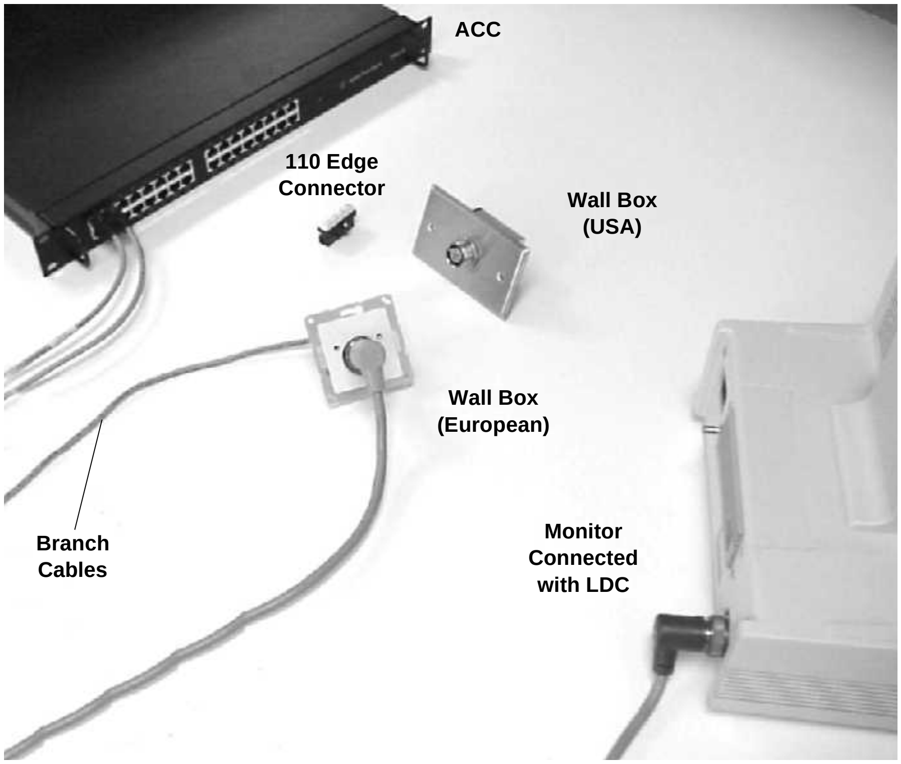


Figure 6-1. Component Parts of a Typical SDN System

Installation Responsibilities—Customer and Agilent Technologies

The site preparation installation responsibilities for installing the component parts of the SDN are outlined below. Specific details of Agilent Technologies Customer Engineer's (CE's) responsibilities for installation and verification are given in this section.

Refer to the Site Preparation Check Lists shown on page 7-1 to ensure proper timing of' installation requirements and materials.

Customer Installation Responsibilities

- Determine the SDN system configuration (assisted by Agilent Technologies sales/service personnel).
- Order the Agilent CareNet Controller (ACC), LDCs, LDC connector kits and faceplates, installation options, and other instruments.
- Choose the installation sites for the ACC and connecting system instruments.

- Measure each length of branch cable and order the appropriate branch cable spools. Refer to page 8-11 for spool sizes and related part numbers. Consider service loops — order 10% longer cable lengths. NO SPLICING — BRANCH CABLE RUNS MUST BE CONTINUOUS.
- Prepare the sites:
  - Ensure sites conform to environmental specifications.
  - Install AC power receptacles within 1.8 m (6 ft.) of instruments connected to the SDN, and install AC power receptacles within 1.5 m (5 ft.) of the ACC.
  - Install wall mounts, consoles, etc. for mounting monitoring and display instruments.
- Supply and install branch cable enclosures (conduit, troughs, raceways, etc.) when necessary.
- Supply and install NEMA switch wall boxes near each instrument (2 3/4-inch depth minimum with conduit knockouts).
- Receive and store equipment and instruments.
- Install and test UTP cable using Category 5 rules with AMP 110 edge connectors.
- Supply a standard 19" telecommunications rack or:
- Mount a plywood panel 40.6 cm wide x 50.8 cm high x 1.9 cm deep, minimum (16 in. W x 20 in. H x 3/4 in. D) to wall surface at the chosen ACC site location. DO NOT MOUNT ACC TO WALL SURFACE.
- Install branch cables from plywood panel (ACC site location) to the switch wall boxes. Leave at least a 4-foot service loop at the plywood panel (ACC).
- Supply certification of Category 5 UTP installation to Agilent installer.
- Ensure cable installation conforms to local building codes.
- Schedule Agilent Technologies service personnel to interconnect parts and instruments of the SDN.
- Schedule key operator training for SDN system operation.

Agilent Installation Responsibilities

- Assist customer in planning system configuration.
- Inspect each instrument site for conformance to environmental specifications and service access requirements.
- Supply system distribution branch cables, connectors, and faceplates.
- Mount the ACC to the plywood panel or rack mount.
- Connect branch cables to each wall box.
- Connect branch cables to the ACC.
- Install the instruments.
- Connect the instruments to the SDN.
- Perform comprehensive system verification procedures.
- Train key operators to ensure proper SDN system operation.

Section 7: Site Preparation/ Installation Checklists

Introduction

The following pages contain the checklists for site preparation and installation.

Agilent Technologies Representative Checklist Prior to Installation

(New Hospital Building)

___ Conference with hospital personnel.

___ Conference with hospital architect.

___ Establish type of patient monitors at bedside and remote areas.

___ Establish Information Center customization (alarms, scales, and recording parameters, for example).

___ Review the definition of Care Units, bed labels, and tuning ranges with hospital personnel.

___ Architect aware of number of conduit runs required.

___ Architect aware of recommended conduit size. Refer to Table 8-1 on page 8-10.

___ Architect aware that no other wires should be run in the same conduit with signal cables.

___ Architect aware that AC power, diathermy cables, and so on should be run far enough away from site to prevent interference—at least 0.3 m (1 ft.) away.

___ Architect aware that Agilent Technologies recommends NEMA conduit switch wall boxes with a minimum depth of 7 cm (2 3/4 in.) with conduit knockouts (such as RACO 560 or 562).

___ Architect aware that builder must supply and install Bedside and Information Center wall boxes.

___ Architect given dimension of the SDN Agilent CareNet Controller (ACC).

___ Architect aware that plywood panel must be mounted at the ACC site location 40.6 cm high x 50.8 cm wide x 1.9 cm deep (16 in. H x 20 in. W x 3/4 in. D) minimum for wall mounting. If rack mounting, architect aware that 19" telecommunications rack supplied.

___ Architect aware that Agilent Technologies supplies bedside and Information Center switch wall box faceplates with LDC connector kits.

___ Architect aware that Agilent Technologies supplies SDN Agilent CareNet Controller (ACC) which is to be installed by Agilent Technologies service personnel.

___ Architect aware that Agilent Technologies will supply instrument wall mounts which are to be installed by the builder.

___ Architect aware that individual 3-wire AC outlets are recommended for each beside instrument, each Information Center, computer, and the ACC.

___ Cables have been identified by bed number or remote site number and ordered after cable length from point-to-point has been carefully measured by the hospital. Order at least 10% longer overrun to prevent a cable too short to do the job. Refer to “Install Branch Cables” on page 8-11 for cable ordering information, and order the associated spools to accommodate branch cable run requirements.

NO SPLICING—CONTINUOUS CABLE RUNS ONLY.

___ Architect aware that the builder must install cables (and cable enclosures when necessary).

___ Confirmed day scheduled for patient monitoring equipment installation with hospital personnel assigned.

___ The “clerk of works” has a move-in day assigned for the equipment.

Note Go over checklist and correspondence again; it will be worth the effort! Oversights will cause delays; delays often run costs up exponentially.

Agilent Technologies Representative Checklist Prior to Installation

(Established Hospital Building)

___ Conference with Superintendent.

___ Establish site locations in building.

___ Establish number of bedside units and review the definitions of Care Units, bed labels, tuning ranges.

___ Establish type of patient monitors at bedside and remote areas.

___ Establish type of Information Center customization (alarms, scales, and recording parameters, for example).

___ Plant engineer (or electrician)/architect aware of the number of conduit runs.

___ Plant engineer/architect aware that he should call for recommended conduit for all cable runs, that installation is the responsibility of the hospital. Refer to table Table 8-1 on page 8-10.

___ Plant engineer aware that hospital is responsible for supplying and installing wall boxes–NEMA conduit switch wall boxes with a minimum depth of 7cm (2 3/4 in.) with conduit knockouts (such as RACO 560 or 562).

___ Outline dimensions and specifications given to plant engineer/architect of recommended NEMA bedside switch wall boxes (such as RACO 560 or 562).

___ Plant engineer/electrician aware that cable pulling is the responsibility of the hospital and “pull boxes” are required (local electrical code) at recommended intervals based on number of conduit bends and cable length.

___ Plant engineer/electrician/architect aware that no other wires should be run in the same conduit with signal cables.

___ Plant engineer aware that installation of Agilent Technologies supplied wall mounts is the responsibility of the hospital.

___ Plant engineer/electrician/architect aware that AC power diathermy cables, and so on should be run far enough away from site to prevent interference–at least 0.3 m (1 ft.) away.

___ Plant engineer given dimension of the SDN Agilent CareNet Controller (ACC).

___ Plant engineer aware that plywood panel must be mounted at the ACC site location 40.6 cm high x 50.8 cm wide x 1.9 cm deep (16 in. H x 20 in. W x 3/4 in. D) minimum, if unit is wall mounted. If rack mounting, aware that 19" telecommunications rack must be mounted.

___ Plant engineer aware that LAN cable must be Cat. 5, installed, and certified.

___ Plant engineer/electrician aware of the number and location of AC power 3-wire (one ground wire) outlets.

Note Each IC requires two AC outlets and each recorder or hard copier requires one AC outlet.

___ Point-to-point cable length measurements according to bed numbers have been received. Order at least 10% overrun to prevent getting a cable too short to do the job.

NO SPLICING—CONTINUOUS CABLE RUNS ONLY.

___ Confirmed move-in date with administrator and electrician.

___ Confirmed move-in date with head nurse so that patients in wing will be assured minimum discomfort while the installation is being made.

___ The “clerk of the works” has a move-in day assigned for the equipment.

Note Go over the check list and correspondence again; it will be worth the effort! Oversights will cause delays; delays often run cost up exponentially.

Architect Checklist
Prior to Installation

___ Builder knows the number, size, and location of conduit runs.

___ Builder knows the number, location, and voltage of AC power outlets.

___ Builder knows location and number of each type of system outlet box.

___ Builder/electrician aware that he must install switch wall boxes (and conduit when necessary).

___ Builder and electrician aware that only patient monitor signal cables can be run in conduit and that AC power, diathermy cables, and so on, should be run far enough away to prevent interference—at least 0.3 m (1 ft.) away.

___ Builder aware that Agilent Technologies requires NEMA conduit switch wall boxes at each bedside station, remote station, and possibly at the Patient Information Center.

___ Builder aware that Agilent Technologies will supply faceplates for standard NEMA switch wall boxes.

___ Builder aware that Agilent Technologies will supply SDN Agilent CareNet Controller (ACC).

___ Builder aware that Agilent Technologies may supply SDN or LAN cables.

___ Builder aware of mounting requirements of brackets and shelves if these are to be used.

Hospital Representative Checklist
Prior to Installation

Building

___ Route from receiving dock to system site can accommodate equipment (ceilings, stairways, corridors, elevators, and so on).

Area Layout

___ Floor plan has been established and permits access to equipment for service and operation.

___ Storage area is available for manuals, accessories, and consumables. Contact your local Agilent representative for space requirements.

Environment

___ Floor can support equipment.

___ Ventilation or air conditioning maintains ambient temperature between 5° C and 30° C (41° F and 86° F) at less than 80% relative humidity.

Electrical Power

___ Power distribution type has been established and proper receptacles provided. Proper hospital grade connector has been selected and Agilent representative notified of selection.

___ Grounding precautions have been taken.

___ A separate circuit, capable of handling present and future loads, has been installed.

Miscellaneous

___ Review definition of Care Units, bed labels, and tuning ranges with hospital personnel.

___ Variable length cables have been measured and specified with related labels.

___ Conduit and outlet box installation has been planned and completed.

___ Sufficient consumables have been ordered.

___ Bedside station, remote area, and Patient Information Center instrument mounts have been planned/installed.

___ Plywood panel has been installed at the ACC site location, if mounting unit on the wall or access to 19” telecommunications rack if rack mounting unit.

___ Operator training for medical personnel has been scheduled.

Verification Procedures

Overview of SDN/ACC Installation and System Communication Verification Procedures

The following overview depicts the recommended order of on-site customer engineering activities during SDN/ACC component installation. Refer to the associated section as indicated to perform the detailed installation procedures and follow the SDN/ACC installation procedures in the sequence indicated.

1. Planning and configuration review
2. Standalone instrument verification and installation
3. SDN wiring installation
4. Instrument connection to the SDN
5. System communication verification
6. Simple practical checks

Planning and Configuration Review

Make sure all instruments and SDN components of the SDN communication system have been received and delivered to the appropriate installation site.

Review SDN system configuration.

Standalone Instrument Verification and Installation

Unpack the instruments at their installation location. Follow the detailed unpacking instructions supplied with each instrument.

It is recommended that proper operation of the instrument be verified prior to mounting. Use the performance verification procedures listed in each product’s service manual, including any self-test procedures, to properly verify the functional operation of the instrument.

Refer to “SDN Error Messages and Error Codes” on page 3-5 for a listing of SDN fault messages for instruments not connected to the SDN.

Unpack the ACC and mount it to a 19” rack. Optionally, wall mount it to the installed plywood panel (refer to “ACC Wall Mounting Procedures and Power Installation” on page 8-8). Verify the functional operation of the ACC by plugging it in and checking the LEDs.

Section 8: Installation

SDN Installation

SDN Wiring Installation

UTP, SDC, or XSDC cables should be continuous from the location of the ACC to the wallbox. Refer to pages 8-11 through 8-16 for more information.

Instrument Connection to the SDN

Connect the instruments to their associated wall boxes using LDC cables. Plug in any ACC terminated LDCs to the upstream connector in the IC. Daisy-chain ICs which are to share one branch. Turn on power to the instruments. Ensure that each SDN bedside instrument is in Demo Mode.

System Communication Verification

Verify the tuning range of each IC. Tune in SDN bedsides at IC. This checks the SDN broadcast function of those bedsides and the SDN receive function of the IC. Refer to the detailed procedures given in the IC documentation.

Ensure that each SDN bedside instrument is in Demo Mode.

If instruments are missing, note their branch numbers and refer to “SDN and ACC System Level Troubleshooting” on page 3-1.

Practical Checks

At each SDN bedside, verify that the UNIT ROSTER and BED LABEL correspond with what the hospital staff wants at that location. Errors indicate mistakes in wiring to the correct branch or mistakes in IC programming.

Enter OVERVIEW mode for each bedside and verify the SDN receive communication function of each SDN bedside. Step through several beds using the NEXT BED softkey. Notice the bed label change. Press the CLEAR hardkey.

While at each SDN bedside, request a REAL TIME recording and verify the interactive SDN communication between bedsides and ICs. Press REAL TIME softkey, select a waveform to be recorded (softkey), look for message

“CONTINUOUS RECORDING” at top of screen, wait about five seconds and press the STOP softkey.

Reset each IC and verify that there are no error codes. Examine the recorder strip to verify that ICs sharing the same recorder(s) are all on the same SDN branch. Verify that each IC has a unique Box No. (0-3) and IC I.D. No. (1-6).

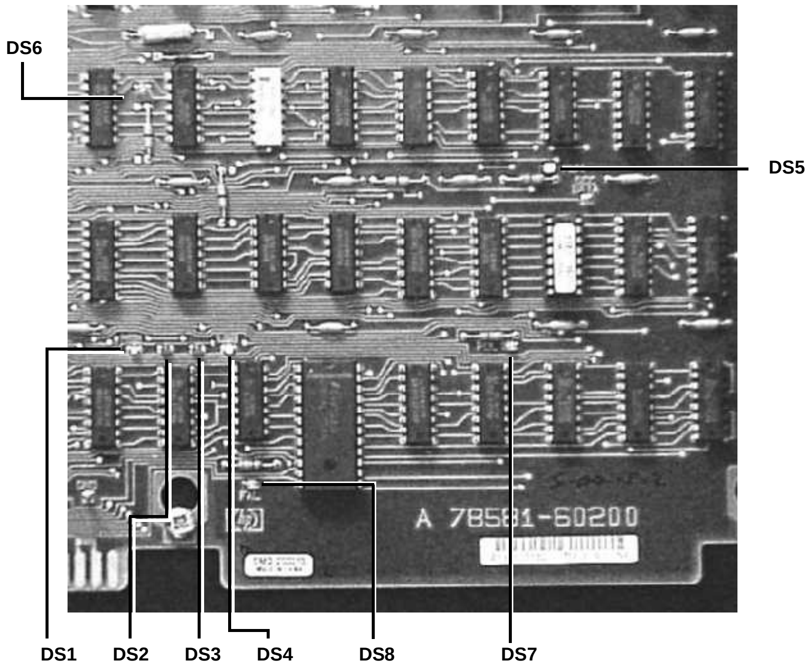
Test and Inspection Procedures

The following test and inspection procedures are done by an Agilent-qualified service provider at the time of installation or repair.

Test Block Name	Test or Inspection to Perform	Expected Test Results	What to Record on Service Record
Visual:	For installation, perform visual inspection of shipping case and contents. All other cases inspect installed device.	No visible damage	**V:P** or **V:F** Where P=Pass and F=Fail
Power On:	1. Power on device. 2. Examine all LED’s on the main PCB for normal operation. The following is “normal operation” • LED condition DS6 Solid Red On DS5 Solid Green On DS1 Fast Flicker Red On DS2 Off (Red) DS3 Off (Red) DS4 Solid Red On DS8 Off (Yellow) DS7 Off (Yellow) Refer to Figure 8-1. Examine the green LED on the front of the unit and the LED on the power supply on the rear of the unit. Are all LEDs indicating normal operation?	Expected answer is “Yes”	**PO:P** or **PO:F** Where P=Pass and F=Fail
Performance:	1. Verify correct cable to branch location by turning on the bedside monitor and checking for proper branch numbering. 2. Perform operational checkout. Scroll through all connected beds in Overview, or tune in all connected beds into the central station. Does the system pass the performance checkout?	Expected answer is “Yes”	**P:P** or **P:F** Where P=Pass and F=Fail

<table>
<tr><th>Test Block Name</th><th>Test or Inspection to Perform</th><th>Expected Test Results</th><th>What to Record on Service Record</th></tr>
<tr><td colspan="4">

Figure 8-1. Main PCB Board LED Locations



</td></tr>
<tr><td>Safety:</td><td>1. Has the secondary ground wire been attached to the 78581B? If “No” proceed to step 2
2. Attach secondary ground if missing or visually inspect ground connections at both ends of the attached secondary ground, then proceed to step 3.
3. Confirm that all locations for all connected branches are at the same ground potential.
Procedure: Measure the voltage between the ground coming through the SDN wall box and the third wire ground of each instrument’s wall outlet (power outlet). The value should be less than or equal to 0.5V RMS.
-OR-
Perform Safety (1) test on all the connected devices.
• If “yes”, done and record S: P.
• If “no”, proceed to step 4.
4. Look at all bedsides for either an attached secondary ground wire or a M1965A potential separator connected to each bed where the voltage was greater than 0.5V RMS.
• If “yes”, done and record S: P.
• If “no”, proceed to step 5.
5. Install secondary ground wire to bedside for any connection where the ground potential was greater than 0.5 V RMS.
Done and record S: P.</td><td>Expected answer is passed</td><td>S:P or S:F
Where P=Pass and F=Fail.</td></tr>
</table>

When to Perform

SERVICE EVENT	Test Blocks Required
Installation	Perform Visual, Power On, Performance, and Safety Test Blocks
Repair **Main PCB** **Power Supply**	Perform Power On, and Performance Test Blocks. Perform Power On, Performance, and Safety Test Blocks.
Upgrades **Add additional branch terminations**	Perform Power On, Performance, and Safety Test Blocks for each additional branch.
All other Service Events	Perform Power On, Performance, and Safety Test Blocks.

Installation Tools, Materials, and Equipment

The recommended installation tools, materials and equipment that are required to properly install the components of the Serial Distribution Network are listed below.

- Screwdrivers:
  - Posidrive #2
  - Flathead, medium blade, 8-inch shaft
- Insulation stripping tool:
  - Ideal Industries, Sycamore, Ill.
  - Catalog No. 45-128 (or equivalent)
- Heat gun (for heat shrink tubing)
- Wire strippers, for 20 and 16 gauge wire
- Hand drill or power screwdriver

SDN Installation Restrictions and Limitations

The ACC can accommodate up to 32 separate branch cables emanating from it to the wall boxes (instruments) connected to the SDN. Various combinations of patient monitors and patient information center displays may be connected to the SDN providing the system is configured within the restrictions and limitations listed here.

- Up to 24 patients may be connected to the SDN (one patient per branch).
- Up to 6 information centers (ICs) may be connected to the SDN.
- Only compatible Agilent instruments may be connected to the SDN.
- Up to 2 telemetry main frames can be daisy chained.
- Up to 2 computer systems may be connected to the SDN.

Note Do not daisy-chain Information Centers.

ACC

- Branches #1 through #24 are dedicated for patient connected instruments (bedside monitors)—one patient per branch.
- Branches #0, and #25 through #31 are dedicated for non-patient connected instruments (ICs and computer systems).
- Mounting location must conform to the environmental specifications outlined in this manual.
- Mounting location must be within 1.5 m (5 ft.) of an AC power line source.
- ACC is designed to be rack-mounted. However, it can be mounted on a plywood panel using the wall mount kit so that the branch cable runs come into the side of the ACC. Be sure to provide the minimum service access.

Cables

- Any Category 5 UTP can be used. Agilent may supply orange colored, plenum rated UTP.
- All LAN or UTP runs must be Category 5 certified or qualified.
- All SDC or XSDC system distribution cables must be supplied by Agilent. No other type or brand may be substituted.
- Each branch cable run from the ACC to a switch wall box must be continuous; no splicing, no mixing cable types.
- Maximum branch cable lengths (ACC to wall box):
  - SDC standard system distribution cable length must be less than 152 meters (500 feet). This requires the use of M3199AI Option J03.
  - XSDC extended system distribution cable length must be less than 304 meters (1000 feet). This requires the use of M3199AI Option J03.
  - The length of unshielded twisted pair runs must be less than 90 meters (295 ft.).
- Up to two separate XSDCs may be connected to the ACC.
- Branch cables must be routed as far away as possible from AC power lines, air conditioning systems, diathermy units, and so on, to minimize RF and AC interference (at least 0.3 m; 1 ft. away).
- Do not route or place branch cables with other electrical cables in the same cable enclosure. Branch cables may be grouped together in the same enclosure.
- Up to 6 speedy cards can be connected.

- Up to 2 local distribution cables (LDC) and 2 MFs may be daisy-chained to one branch (wall box).
- The maximum total length of all LDCs on a branch must be less than 15 meters (50 feet).
- LDC may be run directly from an IC to the ACC.

Wall Boxes

- Only standard sized, single- or dual-gang, NEMA switch wall boxes with conduit knockouts only—no cable clamps (such as RACO 560 or 562) may be used
(wall box minimum depth = 7 cm; 23/4 in.).

  The use of non-standard wall boxes must be approved by Agilent. In addition, the customer must provide mating faceplates containing the appropriate size connector hole when using non-standard wall boxes.
- Wall box location must accommodate the LDC cable length limitations.

ACC Mounting Location

The Agilent CareNet Controller (ACC) may be wall mounted, vertically, at any convenient central location that permits the length of each branch cable to be less than 152 meters (500 ft.), when using SDC cables, with the exception of up to two (2) XSDC branch cable runs which can measure up to 304 meters (1000 feet) each. Branch cables extend from the ACC to the wall boxes. If using UTP, the length must be less that 90 meters (295 ft.).

Warning **Do not install within eight feet of a patient bedside. The ACC is not suitable for use near a patient bedside. The patient vicinity includes a volume of 5 feet (1.5m) around the patient bedside and 8 feet (2.5m) above the floor.**

Rack Mounting Standard 19" telecommunications rack.

Service Access It is required that the ACC be centrally located to facilitate servicing. Do not mount the ACC inside a closet or underneath a display console. The mounting location must provide for adequate service access and have the required free space around the ACC.

AC Power Source The ACC must be wall mounted within 1.5 meters (5 feet) of an AC power line source.

Environmental Conditions

The ACC mounting location must have adequate ventilation and air circulation, and be in a relatively dust/lint-free, static-free environment.

The operating environmental characteristics of the ACC mounting location must conform to the environmental specifications listed.

Temperature Range (ambient): Operating 0 ^{o} C to 55 ^{o} C (32 ^{o} F to 131 ^{o} F)

Humidity: Up to 95% RH

Altitude: Operating to 4600 meters (15,000 ft.)

Important Instructions

- Allow a minimum of 5.08 cm (2 in.) of clearance on top and bottom.
- Allow a minimum of 1 m (3 ft.) of free space in for service access.
- Do not mount in an unventilated area such as a closet or console.
- Mount within 1.5 m (5 ft.) of an A.C. power source.
- When disconnecting from power, pull the cord cap.
- Power Requirements:
  100 - 240V at 50 - 60 Hz
- Power Consumption:
  80 VA.
- Heat Dissipation:
  51.6 kg/cal/hr (204.8 BTU/hr.).
- Line Conditioning Requirements: None
- Weight:
  14.1 lb. (6.4 kg).

ACC Wall Mounting Procedures and Power Installation

Plywood Panel Mounting Procedures — Customer’s Responsibility

If you are not rack mounting the ACC, it must be mounted directly to a plywood panel that is securely fastened to the wall surface. The plywood panel minimum dimensions are 50.8 cm high x 50.8 cm wide x 1.9 cm deep (20 in. by 20 in. by 3/4 in.). You must also use the wall mount kit.

Since wall constructions vary from hospital to hospital, it is the customer’s responsibility to provide the plywood wall panel and fasten it to the wall surface at the chosen ACC installation site. It must be mounted with the cables entering from the side.

ACC Wall Mounting Procedures

It is Agilent Technologies’ responsibility to mount the ACC to the plywood panel at the chosen location.

a. Orient the mount on the wall so that the ACC has its connection ports pointing towards either side.

b. Using the wall mount, measure and mark on the plywood panel where the holes will be located. Drill a #28 hole (size 0.14 in.) at each location. Make sure the holes are level from the top of the plywood panel.

c. Positing the wall mount over the pre-drilled holes and screw a #10 wood screw into each hole.

d. Mount the ACC onto the wall mount and secure with the rack screws.

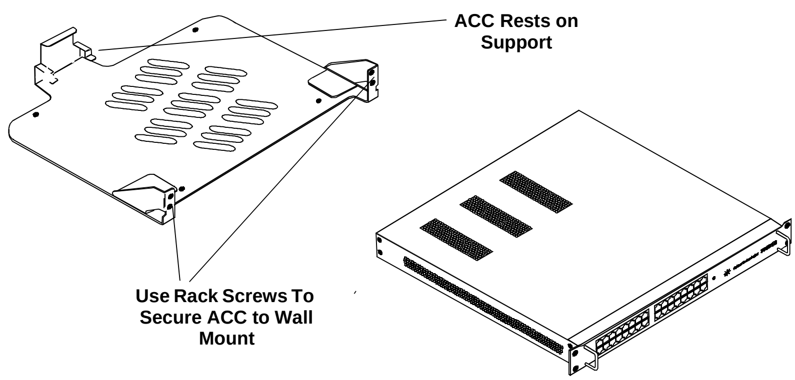


Figure 8-2. ACC shown with wall mount

Note Never mount the ACC with the ports facing up or down as this could cause damage to the cables or connections.

Install Cable Enclosures, Wall Boxes, and Branch Cables

It is the customer's responsibility to install standard NEMA switch wall boxes, cable enclosures, and the required number of branch cables from the ACC to each wall box. Installation of the wall boxes and branch cables must be done in accordance with local and national building codes.

Install Branch Cable Enclosures

It is the customer's responsibility to supply and install suitable cable enclosures such as conduit, troughs, raceways, and so on to protect the branch cables from damage.

Cable enclosures must be dedicated for SDN branch cable runs, or may be grouped together. Do not route or place branch cables with other electrical cables in a cable enclosure.

Cable enclosures must be located as far away as possible—at least 0.3 meters (1 ft.) away—from AC power lines, air conditioning systems, diathermy units, and so on to minimize RF and AC interference.

The size of the cable enclosure is based on the size and number of branch cables running together in the enclosure. The cable or group of cables may occupy up to 30% of the cross-sectional area of the cable enclosure.

A simplified method for selecting the appropriate conduit size is illustrated in Table 8-1 on page 8-10.

For single branch cable runs, it is recommended that 3/4-inch conduit be used for SDC and 1-inch conduit be used for XSDC.

Selecting Conduit Size

Conduit size is directly dependent upon the bends and corners that occur in the run. As a general rule, when conduit bends and corners exist, the conduit size must be chosen so that the cable(s) occupy up to 30% of the cross-sectional area. For straight conduit runs, the enclosed cable(s) may occupy up to 50% of the cross-sectional area.

The following table lists the cross-sectional areas and sizes of SDN branch cables, some common 780 analog cables, and several conduit sizes

.

Table 8-1: Selecting Conduit Size

Cables	Diameter (inches) Nominal	Cross-sectional Area (sq. inches)
UTP Cables	0.196	0.03
SDN Cables:		
SDC, Part No. 8120-3502	0.34	0.09
XSDC, Part No. 8120-3595	0.44	0.15
Conduit Sizes:	0.75	0.44
	1.00	0.79
	1.25	1.54
	2.00	3.14
	3.00	7.07

Using the formula and the examples given below, calculate the correct size conduit to be used to enclose the branch cables in each run.

Formula **Conduit Cross-Sectional Area = 3.33 x (Sum of Cables Cross-Sectional Areas)**

Note If the conduit cross-sectional area does not exactly equal the cross-sectional area of the standard conduit sizes, select the next largest size.

Example One (1) XSDC and two (2) SDC branch cables are to run together in one conduit. What is the proper size conduit to use?

Conduit Cross-Sectional Area = 3.33 (0.15 ± 0.09 + 0.09) sq. in.

Conduit Cross-Sectional Area = 1.10 sq. in.

Therefore, the 1 1/4-inch conduit (1.54 sq. in.) should be used.

Install Standard NEMA Switch Wall Boxes

It is the customer's responsibility to supply and install standard NEMA switch wall boxes with conduit knockouts within the local distribution cable length limitations of where the instrument site will be.

Note

Minimum depth of the wall box must be at least 7 cm (2 3/4 in.).

When installing XSDC branch cable runs, use dual-gang wall boxes to facilitate connector installation.

Agilent Technologies will supply and install faceplates onto NEMA wall boxes. Faceplates are included in each SDN connector kit.

Standard single-gang SDN/UTP faceplate, 1 hole, 78599AI-J12

Standard dual-gang SDN/UTP faceplate, 1 hole, 78599Al-J14

Note

The use of non-standard wall boxes must be approved by Agilent Technologies prior to installation. When non-standard wall boxes are used, the customer must supply the associated faceplates with the appropriate size connector hole.

Install Branch Cables

Agilent Technologies supplies three different spool lengths of SDC branch cable and two different spool lengths of XSDC branch cable. The customer must determine the length of each branch cable run and add approximately 10% overrun. Order the associated spools of branch cable to accommodate your branch cable requirements. Refer to the following spool listing and associated part numbers.

The customer is responsible for installing each branch cable run from the ACC to each wall box. Label both ends of each branch cable with an appropriate destination l.D. (bed number, room number).

Branch cable runs must be continuous; do not splice cables or mix cable types.

Caution

Only branch cable supplied by Agilent Technologies may be used to interconnect the component parts of the SDN. No other type or brand of cable may be substituted, or the warranty may be void.

There are three types of branch cables used to interconnect the ACC to the wall box; unshielded twisted pair (UTP), the standard system distribution cable (SDC), and extended system distribution cable (XSDC). Refer to "SDN Installation Restrictions and Limitations" on page 8-4.

SDC Standard System Distribution Cable

Maximum length per branch cable run: 152 meters (500 feet)

SDC Cable Diameter: 0.8 cm (0.34 inch) dia.

SDC Weight per 30.5 meters (100 feet): 2.9 kg (6.3 lbs)

SDC Spool Lengths: 152-meter (500-ft.) — part number 8120-3774

76-meter (250-ft.) — part number 8120-3775

30.5-meter (100-ft.) — part number 8120-3502

XSDC Extended System Distribution Cable

Maximum length per branch cable run: 304 meters (1000 feet)

XSDC Cable Diameter: 1.1 cm (0.44 inch)

XSDC Weight per 30.5 meters (100 feet): 4.2 kg (9.4 lbs)

XSDC Spool Size: 304-meter (1000-ft.) — part number 8120-3776

229-meter (750-ft.) — part number 8120-3777

Unshielded Twisted Pair Distribution Cable

UTP Orange Plenum Rated—UTP cable 1000' M3199AI-P01

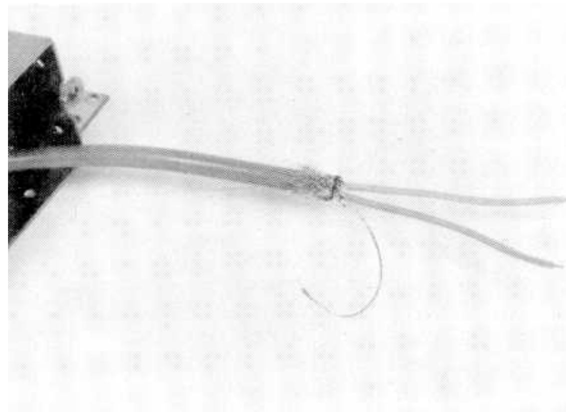
SDC and XSDC Wall Box Connections

It is the customer’s responsibility to install standard NEMA switch wall boxes at convenient locations that are within the length limits of the local distribution cables (LDC). Minimum depth of the switch wall box must be at least 7 cm (2 3/4 inches).

a. Pull the branch cable through the switch wall box so that there is at least 20 cm (8 inches) of free cable to work on.

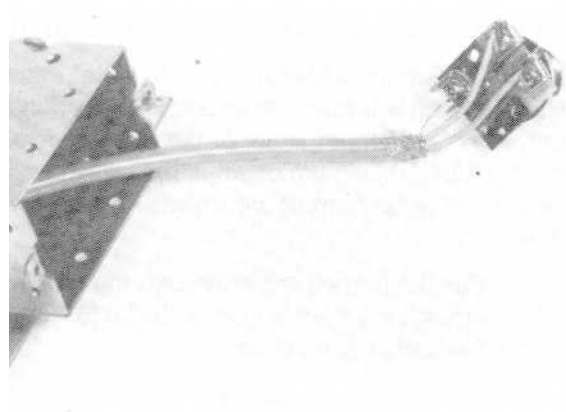
b. Strip off approximately 6.4 cm (2.5 inches) of insulation from the cable end exposing the braided shield. Use care not to cut or damage the braided shield.

c. Carefully, unravel the braided shield from the cable and separate the drain wire. Cut off the first 5 cm (2 inches) of braided shield and fold back the rest of the shield—at least 1.3 cm (1/2 inch)—OVER THE CABLE INSULATION.



d. Remove the foil and filler strips from the cable end and separate the PINK, BLUE, and drain wires.

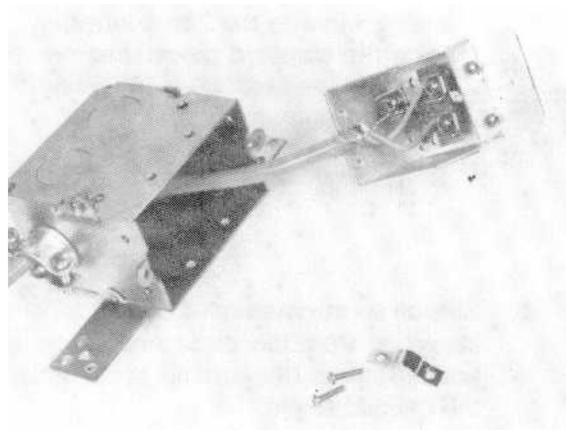
e. Attach the drain wire to the GND terminal connector on the PC board/ SDN connector assembly. Wrap the drain wire completely around the terminal screw.



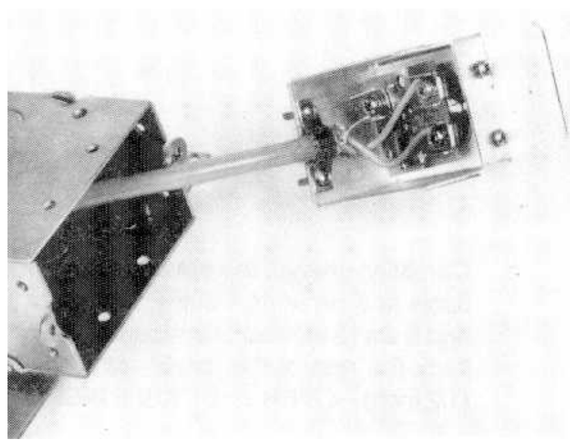
f. With the drain wire extended directly below the PC board/connector assembly, lay the PINK and BLUE wires over their respective terminal connectors and trim the ends at the appropriate length to allow the bare end of the PINK and BLUE wires to be wrapped clockwise three-quarters of the way around the terminal screw.

g. Strip off the insulation from the wire ends. Using long nose pliers, bend the bare wire end into a loop and attach to the appropriate terminal.

h. Place the PC board/SDN connector assembly into the shield cover and secure it in place using the knurled ring. Make sure the connector fits correctly into the key slot of the shield cover and it is fastened securely.

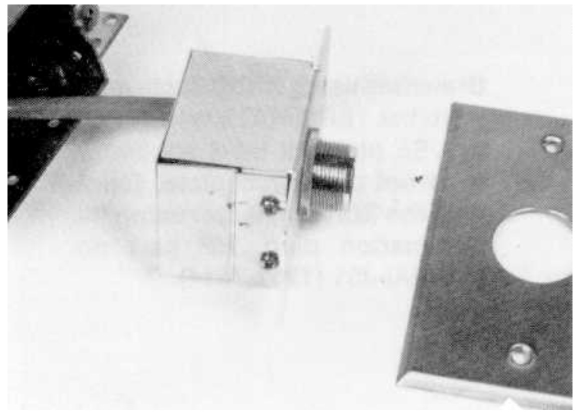


i. Place the cable insulation with folded back braided wire on the bottom edge of the shield cover and clamp securely. The braid should be securely fastened to ensure a good electrical connection between braid and shield.



j. Attach the protective plate to the top of the shield cover using the two screws provided and tighten securely.

k. Insert the shield cover/SDN connector assembly into the switch wall box. Carefully loop the excess branch cable behind the shield cover and push in as far as possible.



l. Attach the faceplate to the switch wall box. Align the holes of the shield cover with the switch wall box and secure the faceplate using the screws provided.

SDN on UTP Wall Boxes Connections

Wall Box Kits for SDN on UTP are available to fit both standard U.S. electrical wall boxes [NEMA, single or dual gang with conduit knockouts, minimum depth = 4.0 cm (1.6 in.)] and typical European wall boxes [minimum depth = 4.0 cm (1.6 in.)]. SDN/UTP single gang switch, Wall Box Kits are shown below for both U.S. (Options J12 and J13) and European (Options JJ1 and JJ2) versions. The kits include the following components.

1. SDN/UTP shield box (with cover) for SDN connection to UTP cable PCB assembly (compatible with world wide requirements and screened twisted pair (STP) cable).
2. PCB assembly (in the connector box).
3. SDN connector for LDC cable.
4. Black anodized ring nut on SDN connector for external identification of SDN on UTP installation.
5. Standard, prepunched, single gang wall plate for SDN/UTP connector.
6. Screw connection for cable earth ground (European version).
7. Tie wrap for use with Screened Twisted Pair (ScTP) cable only (not shown).

UTP Connections

It is the customer's responsibility to install the Category 5 UTP cable, terminate both ends, and certify the UTP installation. RJ45 connections must be at the ACC and 110 edge connector must be terminated at the wall box.

Parts Required Parts required to install the UTP cable are listed in the following table.

Quantity	Description	Part Numbers
1 per ACC branch	LDC Cable	78599AI Option J03 – 3 ft. LDC cable Option J06 – 6 ft. LDC cable Option J10 – 10 ft. LDC cable Option J20 – 20 ft. LDC cable
1 per ACC branch	SDN/UTP single gang wall box unit	78599AI Option J12 – Quantity 1 Option J13 – Quantity 8 Option JJ1 – Quantity 1 (European) Option JJ2 – Quantity 8 (European)
	SDN/UTP dual gang wall box kit	78599AI Option J14 – Quantity 1 Option J15 – Quantity 8
1 per SDC or XSDC cable	RJ45 to connector cable	M3199AI J03

Equipment Needed Equipment needed to install the UTP cable is listed in the following table.

Quantity	Description	Part Numbers
1	Microtest PentaScanner Kit	Contact Anixter (see notes below)
1	Test Adapter, 568A wiring	Amp 558908-I
1	Test Adapter, 568B wiring	Amp 558909-1
1	110 Punch Tool	
1	Screwdriver - Pozi drive #1	
1	Screwdriver - Pozi drive #2	

Note

Before performing the installation, familiarize yourself with the operation of the Microtest PentaScanner.

The Microtest PentaScanner cannot be ordered from Agilent. It can be ordered from the Anixter Corporation.

Fax or mail a purchase order to:
Anixter Corp.
200 Denton Drive
Methuen, Ma. 01844
USA
Phone: 978-682-8870
Fax: 978-682-4744
Provide the following information:
Part number: HP-161851
Bill-to address
Ship-to address
Select the language and voltage you require for your application from the following list. If no specification is made, a North American, 11O V version will be supplied.

North American	110 V
French	22O V or 11O V
German	220 V
Spanish	22OV or 110 V
Italian	220V
UK	240 V, 220 V, or 11O V
Australian	240 V
Japanese	11O V

Procedures

ACC Procedures (78581B)

The following procedures describe the detailed steps for installing a Serial Distribution Network (SDN) between an instrument wall box and the ACC using UTP cable.

The customer is responsible for the following steps:

1. Terminate UTP cable at the ACC end with RJ45 connector.
2. Terminate UTP cable at Wall Box with a 110 edge connector (AMP).

Agilent recommends that the above steps be performed by a licensed LAN installer who will certify the terminated UTP cable. The Agilent installer is responsible for the following steps:

1. Qualify UTP cable if necessary. See “Qualify UTP Cable” on page 8-21.
2. Complete wall box installation. See “SDN on UTP Wall Boxes Connections” on page 8-15.
3. Perform final operational check.

Perform Final Operational Check

1. Plug in ACC.
2. Inspect ACC for proper operation of LEDs.
3. Turn on Central Station and all bedsides.
4. Verify that all bedsides have functioning Overview screens.
5. Verify that all bedsides are displayed at the Central Station.
   If all instruments do not operate properly, use the troubleshooting table below to correct the problem.

Symptom	Possible Cause	Corrective Action
Bed not showing at Central Station	Bed connected to wrong branch at ACC.	Move cable to the port that is connected to the bedside.
	Bed not configured at Central Station	Configure bed at Central Station.
No Overview capability	ACC is off	Plug in power cord.
	Overview not configured On at bedside	Configure Overview On at Bedside. Check ACC for fire axes.
No LEDs on ACC	Defective power supply or power not connected.	Ensure that power cord is connected. Replace power supply.

6. Perform test and inspection matrix.

Serial Communication Controller (SCC) Procedures (78581A)

The following procedures describe the detailed steps for installing a Serial Distribution Network (SDN) between an instrument wall box and the Serial Communication Controller (SCC) using UTP cable. Procedures for connecting the SCC to a patch panel are given for both RJ 45 and 110 punch-down type systems.

Agilent recommends that these steps be performed by a licensed LAN installer who will certify the terminated UTP cable.

Agilent is responsible for the following steps:

1. Qualify UTP cable
2. Complete wall box installation
3. Wire patch cable to SCC
4. Connect patch cable to patch panel
5. Perform final operational check

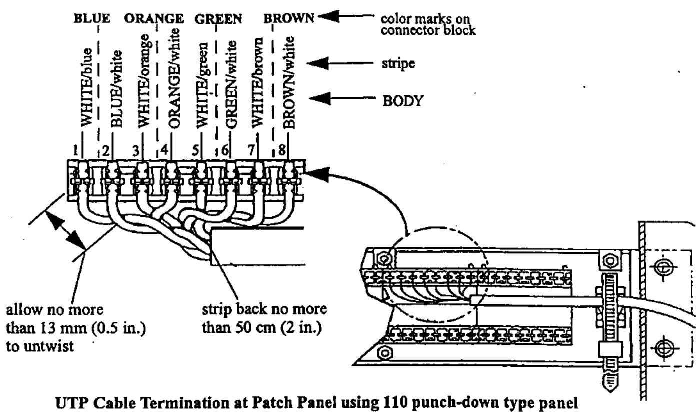
Terminate UTP Cable at Patch Panel

1. Locate SCC.
2. Locate SCC patch panel for new installation.
   Patch panel must be within 8 feet of the SCC.
3. Determine if UTP cable been terminated at patch panel.
   - If YES, proceed to next section, “Terminate UTP Cable at Wall Box.”
   - If NO, terminate patch panel as follows.
4. Terminate UTP cable at patch panel.
   a. Strip back UTP cable insulation no more than 2 inches, keeping twists in wire pairs within 0.5 inch of termination at patch panel.

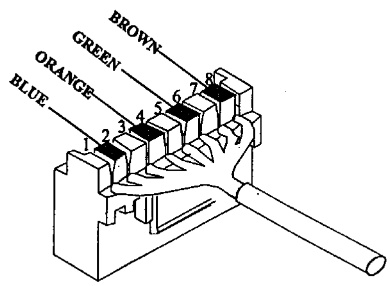
   b. Lay twisted cable over patch panel punch-down connectors.

   c. Using punch tool, punch wires following color code on rear of patch panel. For ease of installation, start wiring patch panel at lowest port and proceed to highest port.

Refer to the following diagram for UTP cable color coding and proper wire connection.



UTP Cable Termination at Patch Panel using 110 punch-down type panel



Terminate UTP Cable at Wall Box

1. Go to bedside wall box and record any numbers associated with UTP cable.
2. Terminate wall box end of UTP cable to match diagram below.
   a. Strip back UTP cable insulation no more than 2 inches, keeping twists in wire pairs within 0.5 inch of termination to punch down edge connector.

   b. Lay twisted pairs over edge connector.

   c. Using punch tool, punch connector as shown below following color coding shown above.

   If using a barrel style connector instead of a punch down style, insert connector ends into appropriate slots of stuffer cap.

   Make sure conductor ends are flush with back of conductor slots.

   An optional stuffer punch down tool (AMP 556706-1) can be used to insert wires into the edge connector stuffer cap.

   d. Have the UTP installation certified as Category 5 by a licensed LAN installer.

Qualify UTP Cable

If the UTP cable installation has not been qualified within the past 12 weeks, Agilent or an Agilent representative must requalify the installation. Following is the procedure for qualification.

Note Calibration of the PentaScanner must be done the day of the test.

1. Insert newly terminated end of wall box UTP edge connector into test adapter B.
2. Attach the short RJ 45 patch cord between Microtest 2-way Injector and test adapter B.
3. Go to patch panel near SCC.
4. Attach an RJ 45 patch cord between Microtest PentaScanner Tester and patch panel port to be tested.
5. Turn on PentaScanner and start Autotest.
   If tester displays "Injector not found," move RJ 45 patch cord until correct port is found. This port should be labeled as that bed number.
6. Perform Autotest (see PentaScanner User's Guide for proper use of Microtest PentaScanner).
   The following table gives acceptable values.

Tests	Specifications
Cable Length	Less than 90 meters (295 ft.)
Splices in Cable	None
DC Resistance	Less than 8.5 ohms
Mutual Capacitance	Less than 5.6 nanoFarads per 90 meters (295 ft.)
Structural return loss	1 - 20 Mhz: 23 dB 20 -100 Mhz: 23 -10 log (f120) dB
Impedance	100 ohms +1- 15%

Tests	Specifications		
Attenuation (per 90 meters) @200C) NEXT (>90 meters)	Freq.(Mhz)	NEXT (dB)	Attenuation (dB)
	0.772	64	1.6
	1.0	62	1.9
	4.0	53	3.9
	8.0	48	5.3
	10.0	47	5.9
	16.0	44	7.4
	20.0	42	8.3
	25.0	41	9.5
	31.25	39	10.6
	62.5	35	15.4
	100.0	32	19.8

7. Record test values and port label.
   If port has no label, assign a bed or branch number to that port.

Note

Test values may be stored in the PentaScanner and then downloaded to a PC or printer to obtain a printed report of all tested branches. The PentaScanner automatically calculates and reports all tests with either a pass or fail status.

8. If test values meet specifications, the cable is qualified.
   If not, use the troubleshooting table below.

Symptom	Possible Cause	Corrective Action
Failed cable-length test	Cable> 90 m (295 ft.)	Install SDC or XSDC cable
Failed noise test	Noise sources close to UTP cable	Install SDC or ScTP cable
Failed splice-in-cable test	Damaged UTP Cable	Re-pull UTP cable
Failed wire-map test	Broken wire in UTP Cable	Re-terminate indicated wire, or re-pull UTP cable
	Crossed pairs in UTP Cable	Re-terminate indicated pairs
	Wrong adapter used in PentaScanner test	Match PentaScanner adapter to patch panel wiring — A or B

Symptom	Possible Cause	Corrective Action
Failed impedance test	Check cable jacket for Category 5	If cable not Category 5, repull Category 5 cable
Failed NEXT test	Cross talk from other pairs	Re-terminate punchdown connections at both ends. If it still fails, check wiring for wiring scheme — A or B.
	Check cable jacket for Category 5	If cable not Category 5, repull Category 5 cable

When cables are qualified for all bedsides and central station locations, remove Tester and Injector.

Install Local Distribution Cables

Installation of local distribution cables (LDC) is the responsibility of Agilent Technologies service personnel. Refer to "SDN Installation Restrictions and Limitations" on page 8-4.

Local distribution cables (LDC) are used for local series connection from the wall box to the instruments downstream. Up to two (2) separate instruments may be connected together via LDCs to each wall box—one patient per branch.

The local distribution cables are supplied in four standard lengths to meet most installation requirements. Unique keying along with color-coding connectors prevent erroneous cable connections. Each connector contains a metal retaining ring that holds the LDC cable to the connector receptacle to prevent accidental disconnection and to provide continuous shielding and ground path. The standard length LDCs are listed below.

Table 8-2: Standard Length LDCs

LDC Length	Agilent Technologies Part Number
0.9 meters (3 ft.)	78599AI-JO3 (8120-3591)
1.8 meters (6 ft.)	78599AI-J06 (8120-3587)
3.0 meters (10 ft.)	78599AI-J10 (8120-3588)
6.1 meters (20 ft.)	78599AI-J20 (8120-3589)

The variable length LDC is available to meet the installation requirements not fulfilled by the standard length LDCs. The variable length LDC is terminated on one end with a standard gray color-coded connector and open on the other end. This open end allows the cable to be cut to any desired length and terminated at the installation site with the associated colored connector. Raw LDC and up/downstream connectors are available also to fabricate LDCs as required.

Table 8-3: Variable Length LDCs

Variable Length LDC	Agilent Technologies Part Number
15.2 meters (50 ft.)	78599AI-J50. Includes molded connector one end and downstream connector to be installed on other end.
15.2 meters (50 ft.)	78599Al-J54. Includes one 15.2 cm (50 ft.) length of unterminated LDC. 78599AI-J52. Includes two SDN connectors—upstream and downstream.

Instructions for terminating the SDN connector onto the open end of the LDC are specified in detail on page 8-25. The length of the LDC is subject to the restrictions and limitations specified on page 8-4.

Connect LDC from Wall Box to Instrument(s)

Connectors on the local distribution cables are mechanically keyed and color-coded to prevent erroneous connection. The color on the connector end of the LDC is either GRAY (DOWNSTREAM) or BROWN (UPSTREAM). The upstream cable direction is from the instrument(s) towards the wall box (ACC) and the downstream cable direction is from the wall box towards the instrument(s). The LDC connectors and receptacles are illustrated in Figure 8-3.

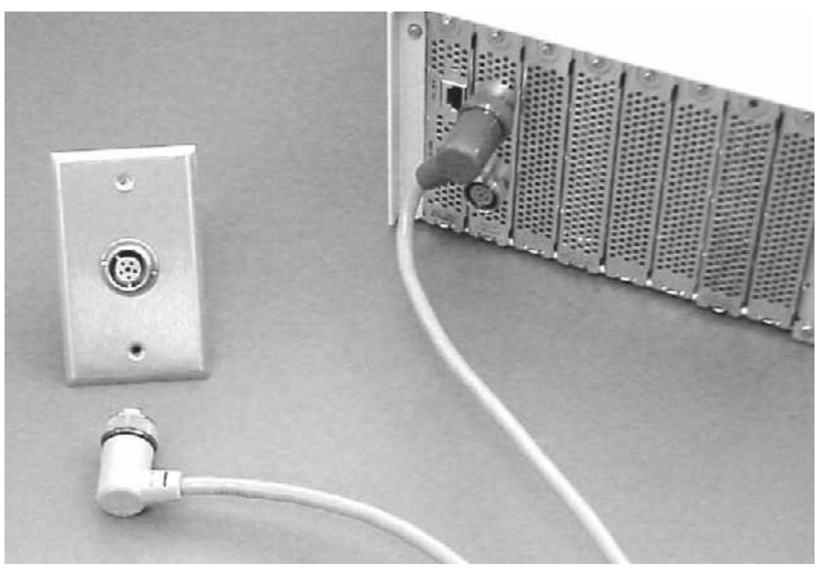


Figure 8-3. LDC Connections from Bedside Instruments to Wall Box

a. Connect the gray color-coded connector to the wall box receptacle. Align the slots in the connector with the keys in the receptacle and push in as far as possible. Secure the connector to the receptacle by tightening the retaining ring onto the receptacle.

b. Connect the brown color-coded connector on the other end of the LDC to the mating brown color-coded connector located on the instrument (bedside monitor). Align the slots in the connector with the keys in the receptacle and push in as far as possible. Secure the connector to the receptacle by tightening the retaining ring onto the receptacle.

c. Connect any additional patient related instruments in series using other local distribution cables. Observe the upstream and downstream color-coding scheme as described above.

Caution **The sum total of all the lengths of LDCs must be less than 15.2 meters (50 ft.).**

Terminate Variable Length LDC

The following procedures can be used to terminate the variable length LDC cable kit Agilent Technologies part number 78599AI-J50 and, also, to terminate the 2-connector kit, Agilent Technologies part number 785-99Al-J52 and 78599Al-J54.

1. Measure and cut the open end of the LDC to the desired length. Leave at least 0.3 meters (1 ft.) overrun to facilitate termination and instrument servicing.
2. Insert the open end of the cable through the connector hardware as illustrated below.
3. Strip off approximately 2.5 cm (1 in.) of insulation from the cable end exposing the braided shield.
4. Use care not to cut or damage the braided shield.
5. Unbraid and peel back the braided shield. Separate the drain/ground wires from the shield and twist together. Fold back the braided shield over the cable insulation.
6. Cut off the foil and filler strips from the cable end.
7. Strip off approximately 6.3 mm (1/4 in.) of insulation from each of the four wire ends to allow the bared end to be soldered onto the connector contacts.
8. Solder the four wire ends and the drain wire to the respective terminal contacts as indicated below.

9. Connect:
PINK WIRE (positive) ---------->pin A
BLACK WIRE (negative) ---------- >pin B
GRAY WIRE (positive) ---------- >pin C
DRAIN WIRE (GND) ---------- >pin D
BLUE WIRE (negative) ---------- >pin E

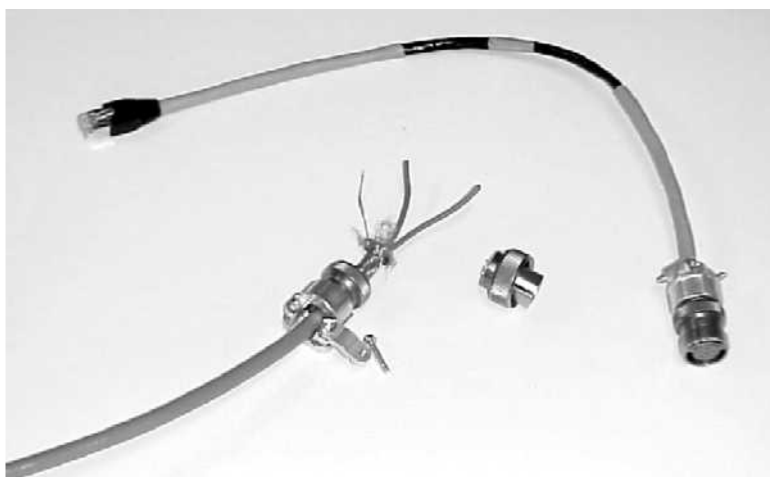
10. Slide the connector locking ring forward over the connector as far as possible.
11. Screw the backshell onto the connector and tighten.
12. Gently, slide the cable clamp over the folded back braided shield and screw the clamp onto the backshell. Do not twist the connector; twist the cable clamp.
13. Tighten down both cable clamps uniformly. Trim off excess braided shield.

Terminate SDC and XSDC Connections

The following procedures can be used to terminate the variable length SDC or XSDC cable. You will need the 78599AI Option J52 kit. From this kit, use the supplied light gray, male connector.

1. Measure and cut the open end of the SDC or XSDC cable to the desired length. Leave at least 0.3 meters (1 ft.) overrun to facilitate termination and instrument servicing.
2. Insert the open end of the cable through the connector hardware as illustrated in the previous figure.
3. Strip off approximately 2.5 cm (1 in.) of insulation from the cable end exposing the braided shield.
4. Use care not to cut or damage the braided shield.
5. Unbraid and peel back the braided shield. Separate the drain/ground wires from the shield and twist together. Fold back the braided shield over the cable insulation.
6. Cut off the foil and filler strips from the cable end.

7. Strip off approximately 6.3 mm (1/4 in.) of insulation from each of the two wire ends to allow the bared end to be soldered onto the connector contacts.
8. Solder the two wire ends and the drain wire to the respective terminal contacts as indicated below.
9. Connect:
   PINK WIRE (positive) ---------->pin A
   DRAIN WIRE (GND) ---------- >pins B, C, and D
   BLUE WIRE (negative) ---------- >pin E
10. Slide the connector locking ring forward over the connector as far as possible.
11. Screw the backshell onto the connector and tighten.
12. Gently, slide the cable clamp over the folded back braided shield and screw the clamp onto the backshell. Do not twist the connector; twist the cable clamp.
13. Tighten down both cable clamps uniformly. Trim off excess braided shield.
14. After you create the cable, screw the connector to the M3199AI option J03 (78581-60350).
15. Plug the RJ45 end into the appropriate port on the ACC. Refer to the following figures.



Section 9: SDN/ACC System Safety

Compliance with IEC 60601-1-1

Connecting the ACC to other medical and non-medical devices creates a medical electrical system. Such systems must comply with IEC 60601-1-1, the Collateral standard to the General Medical Safety standard (IEC 60601) that specifies medical electrical system safety requirements. This standard was developed to address safety issues raised by the increasing sophistication of medical systems, interfacing of medical equipment to other devices, and migration of computers and laboratory instrumentation into the patient care environment. This standard is primarily intended for the systems integrator (installer) who creates the medical system.

The basic philosophy of this system safety standard is to assure that connecting a medical device to any other device will not cause a safety hazard for the patient, the operator, or their surroundings. That is, any system as a whole, or any non-medical device in the patient care vicinity, must provide the same level of safety as an individual medical device that complies with 60601-1.

In practice, this means that the combined chassis leakage current of a medical device and any directly interconnected device must be less than 500 µA (300 µA in the US). If the combined leakage current exceeds 500 µA, the system integrator is responsible for taking actions to reduce the leakage current and bring the system into compliance. Manufacturers are responsible for indicating in their product labeling appropriate steps for an integrator to take to bring a system into compliance.

IEC 60601-1-1 specifically allows the use of equipment that complies with IEC XXX (for example, IEC 60950 for computers or IEC 61010 for laboratory equipment) in the patient care environment provided that the chassis leakage current meets the medical specifications. Meeting these specifications may require the use of a separating transformer. This means, for example, that an IEC 60950 compliant device (for example, a Vectra computer) may be placed next to a patient if it is powered through a separating transformer.

Device Grounding on the SDN

SDN is a ground referenced communication protocol. It requires that the chassis of each device connected to the SDN be interconnected for proper operation. Failure to maintain this connection may result in communication errors and poor performance. In order to maintain a safe system, each device may also require a redundant Protective Earth (PE).

The ACC has been designed to use a redundant PE to insure compliance with IEC 601-1-1 when connected to an SDN. The second PE connection insures system safety. When the ACC is powered using electrical conduit, the conduit provides the second PE. But when the ACC is powered using a power cord, the second PE can be made using the green/yellow wire exiting the ACC. This wire should be connected to the building ground.

The SDN wall box provides for attachment of a PE connection. This connection point should be connected to the building ground. The second PE connections along with measurement of the voltage between the ACC and any SDN medical device ensures system safety.

Figure 9-1. Second Ground on Rear of ACC

Section 10: SDN/ACC Specifications

SDN Specifications

Table 10-1: SDN Specifications

SDN System Specifications	Value
Patients	Up to 24 patients may be connected to the SDN
Central Stations	Up to 6 information centers may be connected to the SDN.
Computer Systems	Up to 2 computer systems may be connected to the SDN
SDN Instrumentation	Only compatible Agilent instruments may be connected to the SDN
Instruments Connected to a Branch	Up to 2 instruments may be connected to each branch of the SDN (one patient per branch) with a maximum of six “speedy cards”
ACC Branch Wiring	ACC Branches #1 through #24 are dedicated for patient connected instruments. Only one patient per branch. ACC Branches #0, and #25 through #31 are dedicated for non-patient connected instruments (ICs and computer systems).
Wall Box Dimensions	Only standard size, NEMA, single- or dual-gang, switch wall boxes with conduit knockouts (KOs) may be used. Minimum depth = 7.0 cm (2.75 in.).
SDN Grounding	The maximum difference in ground potential between the third wire ground delivered to an ACC and the third wire ground delivered to any of its SDN instruments, with the SDN system and local distribution cables disconnected, is 500 mV rms.

SDN System Specifications	Value
SDN Data Transmission Rate	Clock rate of 3.6 Mbits provides a maximum of 7700 useable 12-bit data words per second.
SDN System Distribution Cables	• All XSDC and SDC cables may be supplied by Agilent. • Plenum rated Cat. 5 UTP cable can be supplied by either Agilent or the customer. • Each branch cable run from the ACC to a wall box MUST BE CONTINUOUS; no splicing, no mixing cable types. • Maximum branch cable length: ACC standard distribution cable length must be less than 152 meters (500 feet) for SDC. XSDC extended system distribution cable length must be less than 304 meters (1000 feet). UTP cable length must be less than 90 meters (295 feet). M3199AI option P01. • Up to 2 separate XSDCs may be connected to the ACC. • Up to 2 local distribution cables (LDC) and 2 instruments may be linked to one branch. Maximum total length of all LDCs on a branch must be less than 15 meters (50 ft.). • Cable enclosures (troughs, raceways, conduit, and so on) must be dedicated to branch cable runs only. • Branch cables must be located at least 0.3 m (1 ft.) away from AC power lines, air conditioning systems, diathermy units, and so on, to avoid RF and AC interference.

ACC Specifications

Table 10-2: ACC Specifications

Electrical Characteristics	Value
Power Requirements	100 to 240 VAC -10% to +6% 50-60 Hz
Power Consumption	80 VA
Heat Dissipation	51.6 kg/cal/hr (204.8 BTU/hr)
Line Conditioning	None
Leakage Current	Less than 300 microamps

- Class I
- Equipment not suitable for use in the presence of a flammable anesthetic mixture with air, oxygen, or nitrous oxide.
- IPX0 enclosure not protected against ingress of liquids.
- Mode of operation: Continuous

Table 10-3: Physical Characteristics

Physical Characteristics	Value
Dimensions	1.735" (4.41 cm) x 17.665" (44.87 cm) x 17.25" (43.8 cm) (without wings)
Dimensions of optional wall mount assembly	2.5" (6 cm) x 20.0" (51 cm) x 17.4" (44 cm)
Weight	14.1 pounds (6.4 kg)
Weight with wall mount assembly	24.2 pounds (11.0 kg)
Service Access	Ability to pull ACC forward in the rack-mounted option leaving power cord and secondary ground cable long. LEDs are visible with cover on, but replacement requires removal.

Table 10-4: Environmental Characteristics

Environmental Characteristics	Value
Operating Temperature	0° to 55° C (32° F to 131° C)
Storage Temperature	-40° C to 75° C (-40° F to 167 °F)
Humidity	Up to 95% RH @ 40°C (104° F)
Altitude	Operating = up to 4600 meters (15,000 ft.) Non-operating = up to 15,300 meters (50,000 ft.)

Cleaning

Under normal conditions, cleaning is not required. However if you wish to clean the ACC:

1. Unplug the ACC from the power source.
2. Wipe external surfaces with soft cloth dampened in soapy water (wring out excess water). Be sure not to get fluid inside the ACC.
3. Let the ACC dry completely before use.

System Symbols

The following is an explanation of the symbols found on the hardware components of the Agilent CareNet Controller:

Symbol	Explanation
~	AC Line Current.
REF	Catalog Number
	Date of Manufacture

Symbol	Explanation
	Protective Earth (Ground)
SN	Serial Number
CE	The Agilent Serial Distribution Network (SDN)/Agilent CareNet Controller (ACC) complies with the requirements of the Council Directive 93/42/EEC of 14 June 1993 concerning medical devices and carries CE-marking accordingly
C US	Canadian Radio Equipment Compliance (Canada Only)
Rx	For sale by prescription only.

Contacts

Authorized EU Representative
Agilent Technologies Deutschland GmbH
Healthcare Solutions Group
Herrenberger Strasse 130
110-140
71034 Boeblingen
Germany
Fax: (+49) 7031 464 1552

Index