MICRONET

Net-960CE-S

Mobile Data Terminal

Hardware Guide

June, 2007

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About This Guide

This guide is comprised of the following chapters:

- **Chapter 1, Introducing the Net-960CE-S,** page 10, introduces the Net-960CE-S MDT platform, the developers' package, application development tools and the front and back panel of the Net-960CE-S devices.
- **Chapter 2, Net-960CE-S Technical and Functional Description,** page 18, provides the specifications of the Net-960CE-S's basic configuration and additional options followed by a more detailed description of each of these features.
- **Chapter 3, Net-960CE-S Power,** page 36, describes the various aspects of Net-960CE-S power, such as power management, battery voltage, peripheral voltage supply and power down control.
- **Chapter 4, Net-960CE-S Signal Maps,** page 42, provides various tables mapping the power and communication signals of the Net-960CE-S ports.
- **Chapter 5, Net-960CE-S Installation,** page 58, describes the installation procedure of the Net-960CE-S devices, including bracket mounting, protective back cover mounting and electrical installation.

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Safety Precautions

Congratulations upon your selection of this Micronet product. Please read the following safety precautions before installation or operation.

Usage Precautions

WARNING!

Abnormal Conditions

Should the Net-960CE-S become hot or start to emit smoke or a strange odor, immediately turn off the power and contact your original dealer or an authorized service provider. Continued usage is dangerous and may result in fire or electric shock.

WARNING!

Foreign Objects

Should any foreign matter get into the Net-960CE-S, turn off the power immediately and contact your original dealer or an authorized service provider.

WARNING!

Damage Caused by Dropping

Should you drop the Net-960CE-S and damage it, turn off the power immediately and contact your original dealer or an authorized service provider. Continued usage is dangerous and may result in fire or electric shock.

WARNING!

Moisture

Keep the Net-960CE-S away from vases, planets, cups, glasses and other liquid containers. Water and metal getting into the Net-960CE-S creates the danger of fire and electric shock. Continued usage after water or metal have gotten into the Net-960CE-S is dangerous and may result in fire or electric shock.

CAUTION

Foreign Objects

Ensure that metal or combustible objects are not inserted into the openings of the Net-960CE-S. Such objects may result in fire or electric shock.

CAUTION

Location

Do not place the Net-960CE-S on an unstable or uneven surface. Doing so may cause the Net-960CE-S to fall, which may result in personal injury.

Do not locate the Net-960CE-S in extremely humid or dusty areas. Doing so may result in fire or electric shock.

CAUTION

LCD Screen

Never apply heavy pressure on the terminal display or subject it to a strong impact. Doing so may crack the screen or LCD panel glass, which may result in personal injury.

Should the LCD panel glass break, do not touch the liquid inside. Doing so may cause skin inflammation.

Should liquid from the LCD panel accidentally get into a person's mouth, their mouth should immediately be washed out with water and a physician consulted.

Should liquid from the LCD panel accidentally get into a person's eyes or onto their skin, the area should be rinsed immediately for at least 15 minutes with clean tap water and a physician should be consulted.

Power Supply

WARNING!

- Do not use the Net-960CE-S at a voltage other than specified. Doing so may result in fire or electric shock.
- Avoid conditions that can cause damage or breaks in the power cable. Do not place heavy objects on the power cable and keep it away from sources of heat. Any of the above may damage the power cable, which may result in fire or electric shock.
- Never twist, sharply bend or pull the power cable. Doing so may result in fire or electric shock.
- Should the power cable become severely damaged (to the point that wires are exposed or broken), contact your original dealer or service provider about repair or replacement. Using a damaged electrical cable may result in fire or electric shock.

CAUTION

Keep the power cable away from sources of extreme heat. Heat may melt the covering of the power cable, which may result in fire or electric shock.

Chapter 1

Introducing the Net-960CE-S

About This Chapter

This chapter introduces the Net-960CE-S and contains the following sections:

- **Net-960CE-S MDT Platform – Introduction,** page 11**,** introduces the Net-960CE-S, which provides a platform for a large variety of mobile data applications.
- **Developers Package and Application Development Tools,** page 12**,** describes the Net-960CE-S Developers package which provides all the tools required for application development quick-start, product testing and product evaluation.
- **The Net-960CE-S Device,** page 13, points out the components of the front, back and bottom of the Net-960CE-S device.

Net-960CE-S MDT Platform – Introduction

The Net-960CE-S provides OEMs (Original Equipment Manufacturers) and ASPs (Application Service Providers) with a rugged in-vehicle fixed-mount platform for a large variety of mobile data applications.

The Net-960CE-S is a Windows CE 4.2 .NET-based platform supporting Compact Framework 1.0, which includes a comprehensive development environment for independent application development and integration.

Its cost effective and highly modular design can be adapted to support multiple product configurations and applications types.

The Net-960CE-S platform can be ordered in five standard configurations called Net-960CE-S1, Net-960CE-S2, Net-960CE-S3 , Net-960CE-S4 and Net-960CE-S5. Refer to **http://www.micronet.co.il/product.asp?secID=3&prodID=187** for the Key Feature Comparison Table for these five configurations.

In addition, key features OEM customization is also available. For more details, please contact your Micronet representative.

A screenless (under-dashboard) version of the Net-960CE-S is now available. This has the identical functionality of the standard model, but without a built-in display and keyboard. This version effectively acts as a vehicle control unit, updating the status of the car, location and so on, without any driver interaction. However, an external color display with touch screen can be connected to provide the standard user interface, as required.

Integrated wireless options include: Quad band GPRS modem, GPS, WiFi and Bluetooth.

Physical interface options include: USB, Serial RS-232 ports, SAE J1708 support, CANBus, dedicated RJ connectors - for swipe card, Dallas ID, RFID, high speed counter, two analog inputs - and multiple input/outputs and control signals for vehicle connectivity.

Other optional features include RAM, FLASH and DiskOnChip memory expansions, audio CODEC support for voice calls and speech applications and adaptive automotive interfaces.

Net-960CE-S provides the unique user interface option of an external screen and can interface with any standard, automotive grade, color display (generally available with or without touch screen capability). This special screen configuration is ideal for use with the screenless model and also for use by backseat passengers, for extra navigational comfort and for other interactive on-the-go applications.

Developers Package and Application Development Tools

Micronet's Net-960CE-S Developers package provides all the tools required for application development quick-start, product testing and product evaluation. The Developers package contains all essential hardware and software components, as described below.

Hardware

- Two Net-960CE-S units.
- Two peripheral devices: swipe card reader, Dallas ID button reader and ID button w/plastic holder.
- One interface box for connecting the Net-960CE-S to a PC during the development stage.
- Protective back cover.

Software

- SDK (Software Development Kit) provides a set of software tools, API and documentation for programming in eMbedded C++ 4.0 API and MFC, or Visual Studio .NET for C# and VB development environments.
- C++ and C# Demo application to be installed on the Net-960CE-S units along with a sample runtime application and simulated basic PC/back-office functionality.
- The sample runtime application can be used for off-line product presentation and demonstration as-is, or it can be used as a starting point for coding new applications.
- Various tools are provided to support the Net-960CE-S's numerous interfaces (communication, peripheral and control options).

The Net-960CE-S Device

The state-of-the-art Net-960CE-S MDT (Mobile Data Terminal) displays incoming messages and initiate outgoing messages, transmitted through a wireless communication system. Its rugged design, ergonomic user interface, full programmability and extensive expansion options, make it the ideal mobile data terminal for vehicles. It is built to withstand the extreme temperature range, vibrations and shock that a unit operating within the vehicle environment must endure, ensuring the high level of reliability required by a mission critical, mobile system.

The Net-960CE-S features a variety of ports for communicating with and serving internal and external devices and peripherals. This enables the implementation of an assortment of useful expansion options such as: keyboards, printers, data loggers, bar-code scanners and credit card readers, to mention just a few.

Two internal expansion modules (a wireless GSM/GPRS modem and GPS receiver) may be fitted within the Net-960CE-S PCB. By making use of these options, significant reductions in cost and installation complexity can be achieved.

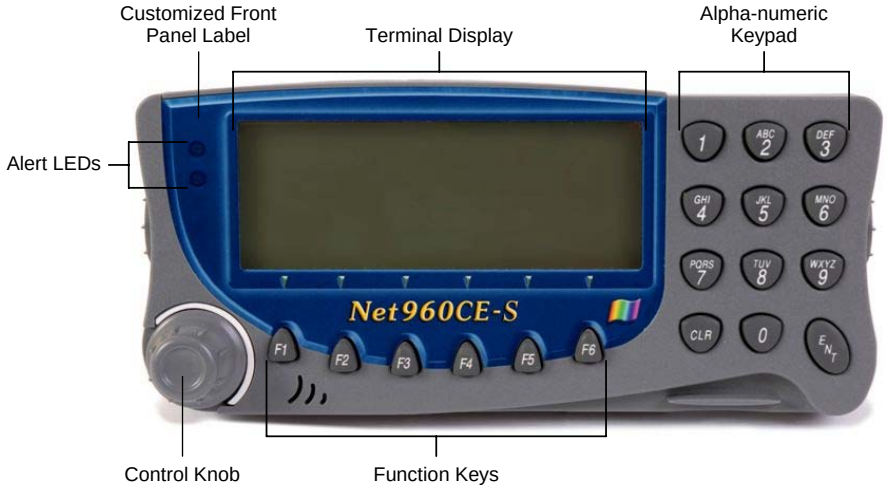


Figure 1: NET-960CE-S Standard Model – Front Panel Components

The table that follows lists the NET-960CE-S standard model Front Panel components and refers you to their descriptions in this manual.

Table 1: NET-960CE-S – Front Panel with a link to component description

Net-960CE-S Components
Terminal Display, page 24
Customized Front Panel Label, page 24
Keyboard (Alpha-numeric Keypad and Function Keys), page 25
Control Knob, page 24
Alert LEDs, page 25
External Display, page 26
Voice Options, page 26

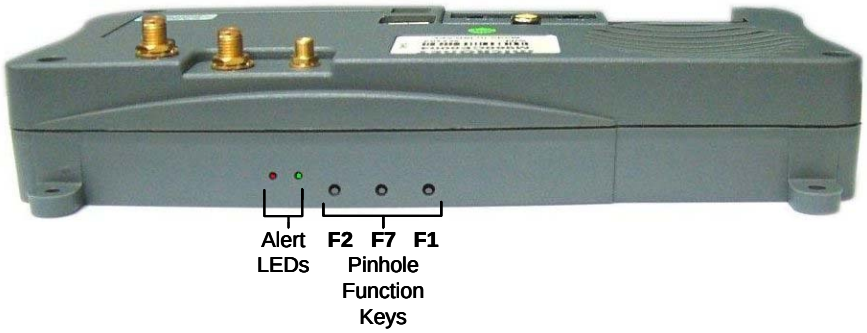


Figure 2: NET-960CE-S Screenless Model – Side Panel

The table that follows lists the NET-960CE-S screenless model Side Panel components and refers you to their descriptions in this manual.

Table 2: NET-960CE-S – Side Panel with a Link to Component Description

Net-960CE-S Components
Function Keys, page 25
Alert LEDs, page 25

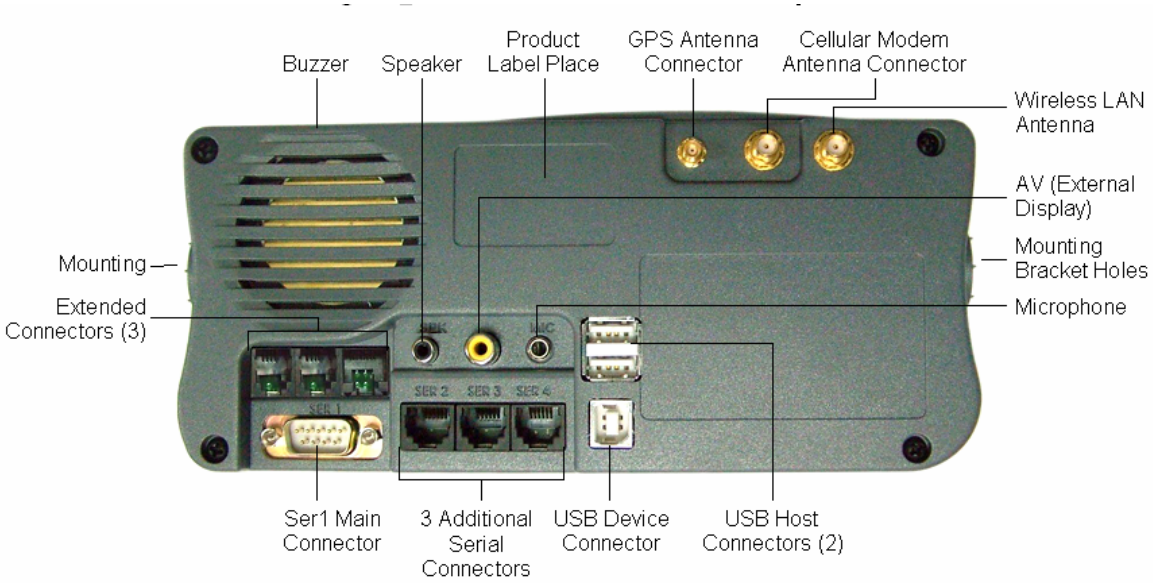


Figure 3: NET-960CE-S – Back Panel Components

Table 3: NET-960CE-S – Back Panel with a Link to Component Description

Net-960CE-S Component
Product Label
GPS Antenna Connector, page 54
Cellular Modem Antenna Connector, page 54
Wireless LAN Antenna Connector, page 55
USB Host Connectors, page 50
USB Device Connector, page 49
SER1 Main Connector, page 43
Three Additional Serial Connectors SER2, SER3 and SER4, page 45
AV (External Display), page 56
Microphone, page 56
Buzzer, page 26
Speaker, page 55
Extended Connectors EXT1, EXT2 and EXT3, page 51
Mounting Bracket Holes, page 59

Figure 4: NET-960CE-S Standard Model – Bottom Panel

Figure 5: NET-960CE-S Screenless Model – Side Panel

Table 4: NET-960CE-S – Bottom Panel with a Link to Component Description

Net-960CE-S Component
SIM Card Slot, page 56

Chapter 2

Net-960CE-S Technical and Functional Description

About This Chapter

This chapter provides a table showing the Net-960CE-S specifications, which is followed by sections that provide more detailed descriptions of each of the Net-960CE-S features.

Net-960CE-S MDT – Specifications

The left column of the following table describes the basic configuration of Net-960CE-S MDT. The right column shows the optional additions to this basic configuration that can be ordered from Micronet at additional cost.

Table 5: Basic Configuration and Options

Basic Configuration and Options	
Basic Configuration	**Options**
Operating System: Windows CE 4.2 .NET CF 1.0 Core license.*	Windows CE 4.2 .NET CF 1.0 Professional license.*
Development Environment and Tools: Full Micronet SDK for Microsoft eMbedded Visual C++ 4.0 and Visual Studio .NET environments	
CPU: Motorola (DragonBall) MC9328MXL 200MHz ARM9, high performance 32-bit RISC engine	
RTC: Car battery backed up Real Time Clock	
System and Application Memory: RAM: 64MB Flash: 32MB	**DiskOnChip:** 1 GB
Graphic Display: Monochrome LCD, FSTN technology, contrast ratio of 7:1, Multilevel LED backlight	Screenless option serves as an under-dashboard MDT model.
	External Display Interface: Standard AV interface for external color display support
	External 7" Color Display with touch screen from a third party

* For a description of supported operating system components, see the *Net-960CE-S Operating System Spec* at http://www.micronet.co.il/product.asp?secID=3&prodID=193

Basic Configuration	Options
Keys: Unique control knob (Encoder switch) 12 Alpha-numeric and 6 function keys (Elastomer) Backlight for all keys	For the screenless model, three pinhole function buttons on the top side of the MDT (which can be pressed by inserting the tip of a pen or the end of an open paperclip)
Alert Indications: Two colored LEDs Buzzer (with programmable frequency and duration)	
Serial Communication Ports: Four RS232 communication ports including one pair of H/W hand-shake control signals	Three RS232 communication ports including one pair of H/W hand-shake control signals, and one SAE J1708 port
Control I/0 Signals: Two automotive inputs signals with counter functionality and One O/C output	Three automotive inputs signals with counter functionality and two O/C outputs *(When using integrated GPRS&GPS configuration)*
USB: One USB 1.1 Device port supports full-speed (12 Mbit/s), for development and debugging	Two USB 2.0 host ports supports full-speed (12 Mbit/s) and low-speed (1.5 Mbit/s) for keyboards, touch screen and storage dongle support
	GPRS modem: Motorola quad band G24 850/900/1800/1900MHz, multi slot class 10, internally connected to COM port 1 – with voice support (requires external speaker and microphone)
	SIM Card access protection sticker
	GPS module: Trimble Lassen iQ 12 satellites, sensitive mode, internally connected to COM port 2
	Wireless LAN: IEEE 802.11 standard at 2.4GHz frequency band. 802.11b and 802.11g protocols
	Bluetooth: Specifications version 2.0 + EDR Class 1 power level

Basic Configuration	Options
Audio Codec: For system sound and GSM voice support (requires external speaker)	
	I/O Signals & Peripherals Support: Two analog inputs One high speed digital counter Dedicated port - Dallas ID button reader Dedicated port - Swipe card reader tracks 1&2 or RFID clock and data interface
	CANBus controller: V2.0B, 1 Mbit port
Power: External power directly from vehicle's battery: 8V-30V DC Power off: Software controlled Power on: By key press or input signal (ignition or VLU)	
Watchdog: Hardware and software watchdog mechanism	
Environment: Operating: -20°C to +70°C (-4°F to +158°F) Storage: -20°C to +80°C (-4°F to +176°F)	Built-in GSM/GPRS module: Operating: -20°C to +60°C (-4°F to +140°F) Storage: -20°C to +80°C (-4°F to +176°F)
Physical Dimensions: Length: 200mm/7.87” Width: 82mm/3.22” Depth: 38mm/1.5” Weight: 390gr./13.8Oz. (Basic configuration)	
	Protective Back-Cover: Protects back panel cables and outputs from tampering
	Private Label: Customers may design their own front panel label. Micronet will produce and supply the MDT with the customized label.

Computer Environment

CPU: Motorola (Dragon Ball), MC9328MXL 200MHz, ARM9, high performance 32-bit RISC engine.

Development Environment and Tools: Full Micronet SDK.

Operating System: Windows CE .NET 4.2 is provided with its Core license and provides the option for a Professional license at additional cost.

For a description of supported operating system components go to the *Net-960CE-S Operating System Spec* at http://www.micronet.co.il/product.asp?secID=3&prodID=193.

System and Application Memory

RAM/SDRAM

The Net-960CE-S provides 64 MB of SDRAM, which is partially allocated for system and application usage.

When using the Windows CE .NET 4.2 Core license, approximately 16 MB of SDRAM memory is allocated for system and the remainder is allocated for application usage.

When using the Windows CE .NET 4.2 Professional license, approximately 27 MB of RAM memory is allocated for system and the remainder is allocated for application usage.

Flash Memory

The Net-960CE-S provides 32 MB of Flash Memory, which can be used to store the Net-960CE-S application and any other required files (such as transactions) and programs that need to be stored permanently.

When using the Windows CE.NET 4.2 Core license, approximately 16 MB of Flash memory is allocated for system usage and the remainder is allocated for storage.

When using the Windows CE .NET 4.2 Professional license, approximately 27 MB of Flash memory is allocated for system usage and the remainder is allocated for storage.

Optional DiskOnChip

An optional 1 GB internal DiskOnChip can be provided for additional permanent storage of large databases.

External Mass Storage

The terminal supports standard external mass storage dongles through the USB Host port.

NOTE:

In order to avoid loss of data, it is recommended that you implement the following memory management techniques:

- Do not connect the terminal power to the ignition switch signal in order to prevent uncontrolled power cut offs. Connect the terminal power directly to the car battery and the ignition switch signal to one of the terminal inputs. When the ignition switch signal has been powered off, use the shutdown function to power off the terminal, ensuring that all files and sessions have first been closed.
- Use the RAM storage for temporary files that are frequently updated.
- Ensure that you close all files that are not currently being used.
- When using extended permanent storage, such as DiskOnChip or USB, saving the application executables in the terminal flash memory and the data on the extended storage is the best way to protect your data.

Real Time Clock (RTC)

The terminal provides a hardware Real Time Clock that operates continuously even when the terminal is powered off, but still connected to the car battery. This option also provides the ability to power on the terminal according to a predefined alarm.

User Interface Options

The following sections describe the interface options for the Net-960CE-S. Note that the terminal display, customized front panel label and control knob do not exist for the screenless model.

Terminal Display

The Net-960CE-S provides a monochrome LCD on the front of the MDT that can be used as primary or secondary user interface screen. This terminal display can be used with or without the External Display, described below, both of which can function independently. The terminal display is based on FSTN technology, provides 240 x 64 pixels, dot pitch of 4.4 x 2.6 mm (.17" x .10"), has a contrast ratio of 7:1 and four LED backlight levels.

Customized Front Panel Label

Micronet provides the option to print a customized front panel label, according to your specifications. Micronet will provide the graphic files and the size specifications to enable you to create your own branding for the terminal's front panel. This is subject to an additional charge per unit, based on quantity. Once printed, Micronet will store the labels and use them for orders placed for this product.

Control Knob

The Net-960CE-S provides a unique control knob (encoder switch), which enables the control of either the terminal display and/or the external display as determined by the application. The control knob is backlit and provides audio feedback. This feature is especially suited for application menu selection or scrolling through lists. This control knob provides three control operations as follows: right (Down key), left (Up key) and push (Space key).

Keyboard

Standard Model

The Net-960CE-S standard model (with screen) provides twelve alpha-numeric and six programmable functional keys (Elastomer). All these keys are backlit, with four levels of programmable illumination, and provide audio feedback. Functional key locations are strategically placed under the terminal display to enable the application to utilize them as a programmable menu.

Screenless Model

The screenless model provides three pinhole function buttons with audio feedback, that can be used for reset and system management for application configuration.

For both models, an external (3^{rd} party) full USB compliant keyboard can be connected to terminal through USB host port.

Alert LEDs

The Net-960CE-S provides two colored LED Alert Indications, one green and one red, both which can blink.

External Display

The Net-960CE-S provides the option of an external color screen connection (via Standard AV interface) enabling a second external (3rd party) screen. For this purpose, Net-960CE-S can interface with any standard, automotive grade, color display (generally available with or without touch screen capability). This special screen configuration is ideal for use with the screenless model and also for backseat passengers, for extra navigational comfort and for other interactive on-the-go applications.

This external screen can be used as primary or secondary user interface screen with or without the terminal display described above, both of which can function independently. This external screen can provide touch functionality connected through the USB host port of the Net-960CE-S.

Voice Options

Buzzer

The Net-960CE-S provides an internal buzzer for indicating alerts with programmable frequency and duration. Two volume levels are available.

Audio Codec

The Net-960CE-S provides an Audio Codec that can sound prerecorded system messages (WAV files). This function requires the connection of an external speaker. For more details refer to the *External Speaker Connector* on page 55.

Communication

Serial Communication

The Net-960CE-S provides four serial communication ports for serving various internal and external devices.

Each of these ports provides different options, as described in the sections that follow. *Chapter 4, Net-960CE-S Signal Maps,* page 42, describes the function of each signal of each Net-960CE-S port.

Serial Port 1 (SER1 Connector)

Generally, Serial Port 1 functions as a main system serial port for modem communication. It provides a maximum Baud rate of 115,200bps and one pair of communication control handshake signals (CTS/RTS). It can provide either of the following two functions, as determined by factory settings:

- **Basic Terminal Configuration (SER1 Connector):** In its basic terminal configuration, Serial Port 1 is physically connected to the SER1 connector and provides the control signal CTS/RTS.

NOTE:

Within the framework of OEM customization, additional RS232 level control signals can be provided. For more information on this subject, please contact Micronet sales support.

Backward compatibility: If your are installing the Net-960CE-S as an upgrade to an existing Micronet device (such as the Net-960EX) and want to connect to the same external devices, please refer to Micronet sales support.

- **Internal Cellular Modem Terminal Configuration:** In this configuration, Serial Port 1 is connected internally to the cellular modem and is not connected to the external serial connector. Refer to the *Cellular Communication* section on page 31 and in the *Serial Port 1 (SER1 Connector)* section, on page 43 for more details.

Serial Port 2 (SER2 Connector)

Serial Port 2 is connected to the SER2 connector. It provides a maximum Baud rate of 115,200bps and one pair of communication control handshake signals (CTS/RTS).

When using the internal GPS option, the Serial Port 2 can switch between the following two functions as determined by the Net-960CE-S's programmable software.

- **SER2 (default setting):** When the Serial Port 2 is set by the application to connect to the SER2 port, it serves as a standard serial communication port for connection to external devices.
- **GPS Receiver:** When the Serial Port 2 is set by the application to connect internally to the GPS Receiver, it can receive GPS data, which makes it especially suitable for navigation applications and traffic reports. Refer to the *GPS Receiver* section on page 32 for more details.

This means that upon software request, Serial Port 2 can switch between the connection to the SER2 connector and the connection to the internal GPS Receiver. For further details refer to the *SER2 Connector* section, on page 45.

Serial Port 3 (SER3 Connector)

Serial Port 3 is connected to the SER3 connector. It can provide either of the following two features, as determined by factory settings.

- RS232 (maximum Baud rate: 115,200bps) with one pair of communication control handshake signals (CTS/RTS).
- SAE J1708 (Baud rate: 9600bps only).

For further details refer to the *SER3 Connector* section, on page 46.

Serial Port 4 (SER4 Connector)

Serial Port 4 can provide either of the following two functions, as enabled by the Net-960CE-S's programmable software:

- **Default Serial Port 4 Configuration:** In this configuration, Serial Port 4 serves as a standard serial communication port for connection to external devices. Its communication standards are RS232 (maximum Baud rate: 115,200bps) with one pair of communication control handshake signals (CTS/RTS).
- **Internal Bluetooth Module Option:** In this option, Serial Port 4 is connected internally to the Bluetooth modem and is not connected to the external serial connector.

For further details, refer to the *SER4 Connector* section, on page 48.

USB Device Port

The Net-960CE-S provides a USB device port to enable connection to devices that have a USB host port, such as laptops. This port is especially useful for interacting with the Net-960CE-S by downloading firmware, applications and configurations. It can also be used for software and technical support.

This functionality complies with Universal Serial Bus Specification Rev. 1.1 and supports full-speed (12 Mbit/s).

USB Host Ports

The Net-960CE-S optionally provides two USB 2 host ports connected through a double USB host connector. These ports enable the connection to devices that have a USB device interface, such as USB printers, USB keyboards, USB memory storage devices and so on. For further details, refer to the *USB Host Connector* section, page 50.

This functionality complies with Universal Serial Bus Specification Rev. 2.0 and supports full-speed (12 Mbit/s) and low-speed (1.5 Mbit/s).

CANBus Port

The Net-960CE-S optionally provides a CANBus port that enables the connection of a variety of vehicle peripherals through the EXT1 connector, such as the vehicle's computer, vehicle's sensors and so on. For further details, refer to the *EXT1 Connector* section, page 51.

The provided CANBus V2.0B (a 1 Mbit port) supports the following functionality:

- 0 - 8 byte length in the data field
- Standard and extended data and remote frames
- Two receive buffers with prioritized message storage
- Six 29-bit filters
- Two 29-bit masks
- Three transmit buffers with prioritization and abort features

Wireless Communication

Cellular Communication

As determined by factory settings, the Net-960CE-S can optionally provide an internal GSM/GPRS Cellular Modem to enable communication functionality between the terminal and any server or back-office.

The Motorola G24 cellular modem that is optionally provided with the Net-960CE-S has the following features:

- Quad band 850/900/1800/1900 MHz
- GPRS Multi slot class 10
- MO/MT SMS
- FAX
- VOICE

The internal modem option requires an external antenna connection and a SIM card.

WARNING

The wireless LAN antenna connector and the GPRS antenna connector on the back panel of the Net-960CE-S are both SMA connectors. Ensure that you connect the correct antenna to the correct connector.

Voice calls can be supported and require an external speaker and a microphone connection, as shown on page 55 and 56.

NOTE:

In this configuration, Serial Port 1 is connected internally to the cellular modem and is not connected to the external SER1 connector.

The bottom of the Net-960CE-S provides a SIM card slot and the back panel of the Net-960CE-S will have a cellular modem antenna connector, as shown on page 17. For further details, refer to the *Cellular Modem Antenna Connector* section, page 54.

GPS Receiver

As determined by factory settings, the Net-960CE-S optionally provides an internal GPS receiver especially suited for navigation applications and traffic reports.

Serial Port 2 can switch between the internal GPS Receiver and the external SER2 connector (page 28 and 45) upon software request.

The Trimble Lassen iQ module is provided with the following features:

- 12-channel simultaneous operation
- Horizontal Accuracy: <5 meters (50%), <8 meters (90%)
- Altitude Accuracy: <10 meters (50%), <16 meters (90%)
- Supports NMEA 0183, TSIP, TAIP protocols

The GPS Receiver requires an external GPS antenna connection. The GPS antenna receives the GPS satellite signals and passes them to the GPS Receiver. The GPS signals are spread spectrum signals in the 1575 MHz range and do not penetrate conductive or opaque surfaces. Therefore, the antenna must be located outdoors with a clear view of the sky. For further details, refer to the *GPS Antenna Connector* section, page 54.

WARNING!

When magnetic-mount or permanent-mount GPS antennas are installed on a metal source for prolonged periods, care must be taken to insulate the antennas in order to prevent galvanic corrosion or electrical damage.

The back panel of the Net-960CE-S provides a GPS antenna connector, as shown on page 16.

Wireless LAN

As determined by factory settings, the Net-960CE-S optionally provides an internal Wireless Local Area Network (IEEE 802.11) module especially suited to high-speed data transfer over the air, when the Wireless LAN hotspots infrastructure is provided. For applications that require large scale data transactions, the Wireless LAN option is the most economical way to implement the solution (as wireless LAN data transactions are free).

The Onboard Wireless LAN module is provided with the following features:

- **Specification Compliance:** IEEE 802.11b/g standard protocol (CSMA/CA)
- **Frequency Range:** 2.412 Ghz~2.484 Ghz
- **Data Baud Rate:** 54 Mbps

The Wireless LAN option requires an external antenna connection.

WARNING

The wireless LAN antenna connector and the GPRS antenna connector on the back panel of the Net-960CE-S are both SMA connectors. Ensure that you connect the correct antenna to the correct connector.

Bluetooth Communication

As determined by factory settings, the Net-960CE-S optionally provides an internal Bluetooth Class 1 module with an internal antenna, which can communicate with a variety of peripherals, such as printers, PDAs, laptops, cellular phones and so on.

This functionality complies with Bluetooth specifications version 2.0 + EDR Class 1 power level.

NOTE:

In this configuration, Serial Port 4 is connected internally to the Bluetooth module and is not connected to the external serial connector. For further details refer to the *SER4 Connector* section, on page 48.

Control Signals

As determined by factory settings, the Net-960CE-S optionally provides a variety of digital inputs and outputs and two analog inputs that can be used to connect devices and sensors at a variety of voltage levels.

Digital Signals

Several digital control input of the terminal can provide counter functionality of up to 1 KHz.

SER1 Control Signals

Depending on the terminal configuration, the SER1 connector can provide up to three control inputs with counter functionality and up to two control outputs at automotive voltage level. These I/Os can be used for the monitoring and operating of external devices.

For further details about voltage parameters and signal configuration, refer to the Serial Port 1(SER1 Connector) section on page 27.

EXT Control Signals

As determined by factory settings, the EXT connectors optionally provide a variety of inputs and outputs in a variety of voltage levels. The EXT connectors can serve dedicated ports for extended device functionality or they can be used as regular control signals.

The EXT1 connector provides one regular digital input, which can be used as a regular control input or as a high speed counter input of up to 1 MHz. For further details, refer to the *EXT1 Connector* section, page 51.

The EXT3 connector provides five digital input signals with counter functionality. These signals also serve the magnetic cards reader interface, and cannot be used as input signals when a magnetic cards reader is connected.

For further details, refer to the *EXT3 Connector* section, page 53.

Analog Signals

As determined by factory settings, the EXT2 connector optionally can provide two analog inputs with a voltage range of 0 to 30V to monitor compatible vehicle peripherals. For further details, refer to the *EXT2 Connector* section, page 52.

Peripheral Support – Dedicated Ports

Magnetic Card Reader Port

As determined by factory settings, the Net-960CE-S optionally provides a magnetic card reader (track 1 and track 2) clock and data interface port connected through the EXT3 connectors that can be used for a variety of applications, such as to read driver identification or credit card transactions. For further details, refer to the *Ext3 Connector* section, page 53.

Memory ID Button Reader Port

As determined by factory settings, the Net-960CE-S optionally provides a 1-Wire interface port (through the EXT2 connector), which provides control, signaling and power over a single-wire connection. By connecting an optional touch probe accessory, Dallas ID Memory Buttons can be used as a means for identification and authorization control. For further details, refer to the *EXT2 Connector* section, page 52.

Chapter 3

Net-960CE-S Power

About This Chapter

This chapter describes the various aspects of Net-960CE-S power, such as power management, battery voltage, peripheral voltage supply and power down control.

Overview

The Net-960CE-S power is drawn directly from the vehicle's 12V/24V DC battery, and provides intelligent power management options that reduce drain on the vehicle’s main battery.

The Net-960CE-S also enables the control of external peripheral power, backlight and power lines for internal modules.

Both internal and external devices can be turned on and off, as required.

Battery Voltage Input

Net-960CE-S power is connected through the SER1 connector pin 8 (+) and pin 5 (-). The nominal voltage supply for the Net-960CE from the vehicle's battery is 12 or 24V. The operating range is between 8 and 30V.

The terminal must be connected directly to the vehicle's battery or VLU (Vehicle Location Unit).

WARNING!

Do not connect the terminal power to the ignition switch signal in order to prevent uncontrolled power cut offs, which may have a detrimental affect on the operating system. Connect the terminal power directly to the car battery and the ignition switch signal to one of the terminal inputs. When the ignition switch signal has been powered off, use the shutdown function to power off the terminal, ensuring that all files and sessions have first been closed.

The Net-960CE-S has no internal fuse, and therefore its connected to the vehicle's power source line should be protected by a 10A fuse. Additionally, a 4A fuse should be added to the power cable with an inline fuse holder for HHC/HHD blade-type fuses.

Table 6: Terminal Power Consumption

Operation Mode	Current Consumption
Power Off	**~ 1mA**
Idle (no active application)	**~ 120mA**
Active (without wireless communication)	**~ 400mA**
Run (with wireless communication)	**~ 750mA**

Power Management

When connected to the car battery, the Net-960CE-S terminal can only be powered down by software control. The applications can be designed to power down the terminal when a signal drop is detected on the input lines. For example, when the ignition is turned off or according to AVL request.

The Net-960CE-S provides three input lines that turn on the terminal upon signal rise. For example, when the ignition is turned on.

In addition, pressing the control knob also turns on the terminal.

A Real Time Clock option also provides the ability to power on the terminal according to a predefined alarm.

NOTE:

Within the framework of OEM customization, one of these input lines can be factory set not to turn on the terminal.

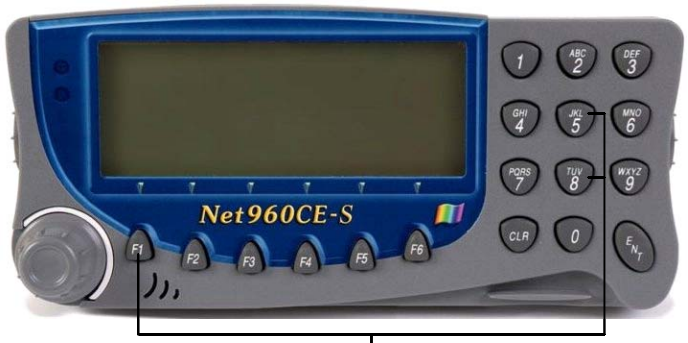
The terminal also has the ability to control the power supply to internal terminal modules.

Watchdog

The Net-960CE-S provides an intelligent watchdog module that provides various options for programming the terminal to automatically reset. For example, after an error and a timeout.

Manual Reset and Boot Mode

The standard model of the Net-960CE-S terminal can be reset by simultaneously pressing the **5**, **8** and **F1** keys.



The screenless model of the Net-960CE-S terminal can be reset by simultaneously pressing the **F1** and **F2** keys.

NOTE:

It is highly recommended not to use the Manual Reset operation. This operation should only be activated by a technician.

This operation should not be activated while the application is running or saving data to the FLASH storage or DiskOnChip, as it may damage FLASH sectors.

Peripherals Voltage Supply

The Net-960CE-S provides programmable operating voltage of 5V for external peripheral devices. This supplied voltage is filtered and stabilized, thus eliminating battery voltage fluctuations and noise. All voltage supply lines are protected and current limited.

This signal is simultaneously connected to the Power Out pins of all SER and EXT connectors. Switching this signal on/off causes the enabling/disabling of all connected peripherals. A total of 700mA of aggregated power can be supplied by the terminal to all connected peripherals.

Chapter 4

Net-960CE-S Signal Maps

About This Chapter

This chapter provides various tables mapping the power and communication signals of the Net-960CE-S ports. The options and functionality of each of these ports are described in detail in *Chapter 2, Net-960CE-S Technical and Functional Description* on page 18.

Some of the connectors described in this chapter, such as the SER1 connector, have two factory configurable options, each of which have a different signaling map. In these cases, two signaling map tables are provided. All pins are protected against electrostatic discharge (ESD protected).

The following lists some of the abbreviations used in the signal descriptions of this chapter:

I Input signal

O Output signal

B Bus signal

V Voltage signal

G Ground

Serial Port 1 (SER1 Connector)

Connector type: D-type 9-pin Male.

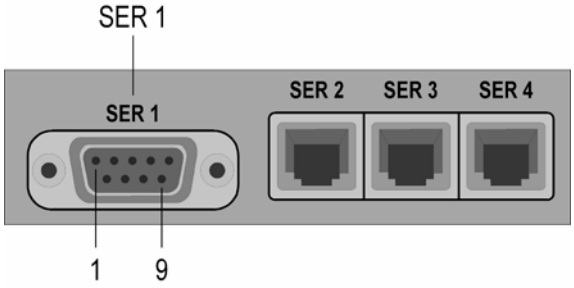


Table 7: (SER1) Connector Pinout for Basic Configuration

Pin	Signal	Type	Function	Specifications
1	SER1_IN1 (DSR)	I	Control Input/ Counter	**Typical** **Min** **Max** Input Low: VIL 0V -30V 6V Input High: VIH 12V-24V +8V +30V Frequency: Up to 1KHz
2	RXD (COM1)	I	Receive Data	EIA-*RS232* level
3	TXD (COM1)	O	Transmit Data	EIA-*RS232* level
4	RTS (COM1)	O	Request To Send	EIA-*RS232* level
5	GND	G	MDT Power Supply Ground	
6	CTS (COM1)	I	Clear To Send	EIA-RS232 level
7	SER1_OUT2 (DTR)	O	Control Output	Open Collector Max. switchable current = 300mA Max. switchable voltage = +VIN Max. saturation voltage = 0.6V
8	+VIN	V	MDT Power Supply Voltage	**Typical** **Min** **Max** +12V-24V +8V +30V
9	SER1_IN3 (RI)	I	Control Input/ Counter	**Typical** **Min** **Max** Input Low: VIL 0V -30V 6V Input High: VIH 12V-24V +8V +30V Frequency: Up to 1KHz

NOTE:

Within the framework of OEM customization, DSR, DTR and RI communication control signals can be provided instead of automotive control I/O.

Table 8: (SER1) Connector Pinout for Internal GPRS/GPS Configuration

Pin	Signal	Type	Function	Specifications
1	SER1_IN1	I	Control Input/ Counter	**Typical Min Max** Input Low: VIL 0V -30V 6V Input High: VIH 12V-24V +8V +30V Frequency: Up to 1KHz
2	NC		Not connected	
3	NC		Not connected	
4	SER1_OUT1	O	Control Output	Open Collector Max. switchable current = 300mA Max. switchable voltage = +VIN Max. saturation voltage = 0.6V
5	GND	G	MDT Power Supply Ground	
6	SER1_IN2	I	Control Input/ Counter	**Typical Min Max** Input Low: VIL 0V -30V 6V Input High: VIH 12V-24V +8V +30V
7	SER1_OUT2	O	Control Output	Open Collector Max. switchable current = 300mA Max. switchable voltage = +VIN Max. saturation voltage = 0.6V
8	+VIN	V	MDT Power Supply Voltage	**Typical Min Max** +12V-24V +8V +30V
9	SER1_IN3	I	Control Input/ Counter	**Typical Min Max** Input Low: VIL 0V -30V 6V Input High: VIH 12V-24V +8V +30V Frequency: Up to 1KHz

Serial Port 2 (SER2 Connector)

Connector type: RJ12 6-pin female.

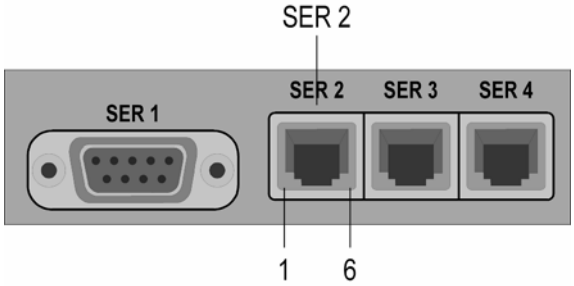


Table 9: (SER2) Connector Pinout for RS232 Configuration

Pin	Signal	Type	Function	Specifications
1	+5V_SW	V	Switched 5V Power Out Pin	+5V±10%; 500mA max. **Note:** This signal is simultaneously connected to the Power Out pins of all SER and EXT connectors. Switching this signal on/off causes enabling/disabling of all connected peripherals. A total of 700mA can be supplied by the terminal to all connected peripherals.
2	RTS (COM2)	O	Request To Send	EIA-RS232 level.
3	TXD (COM2)	O	Transmit Data	EIA-RS232 level. **Note:** This signal can be switched between the internal GPS module and this connector pin.
4	RXD (COM2)	I	Receive Data	EIA-RS232 level. **Note:** This signal can be switched between the internal GPS module and this connector pin.
5	CTS (COM2)	I	Clear To Send	EIA-RS232 level.
6	GND	G	Ground	

Serial Port 3 (SER3 Connector)

Connector type: RJ12 6-pin Female.

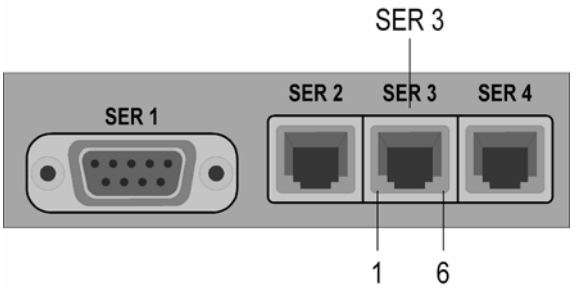


Table 10: (SER3) Connector Pinout for RS232 Configuration

Pin	Signal	Type	Function	Specifications
1	+5V_SW	V	Switched 5V Power Out Pin	+5V±10%; 500mA max. **Note:** This signal is simultaneously connected to the Power Out pins of all SER and EXT connectors. Switching this signal on/off causes enabling/disabling of all connected peripherals. A total of 700mA can be supplied by the terminal to all connected peripherals.
2	RTS (COM3)	O	Request To Send	EIA-RS232 level
3	TXD (COM3)	O	Transmit Data	EIA-RS232 level
4	RXD (COM3)	I	Receive Data	EIA-RS232 level
5	CTS (COM3)	I	Clear To Send	EIA-RS232 level
6	GND	G	Ground	

Table 11: (SER3) Connector Pinout for J1708 Configuration

Pin	Signal	Type	Function	Specifications
1	+5V_SW	V	Switched 5V Power Out Pin	+5V±10%; 500mA max. **Note:** This signal is simultaneously connected to the Power Out pins of all SER and EXT connectors. Switching this signal on/off causes enabling/disabling of all connected peripherals. A total of 700mA can be supplied by the terminal to all connected peripherals.
2	RTS (COM3)	O	Request To Send	EIA-RS232 level
3	-IN (COM3)	B	J1708 Bus Pin (-)	SAE J1708 level
4	+IN (COM3)	B	J1708 Bus Pin (+)	SAE J1708 level
5	CTS (COM3)	I	Clear To Send	EIA-RS232 level
6	GND	G	Ground	

Serial Port 4 (SER4 Connector)

Connector type: RJ12 6-pin Female.

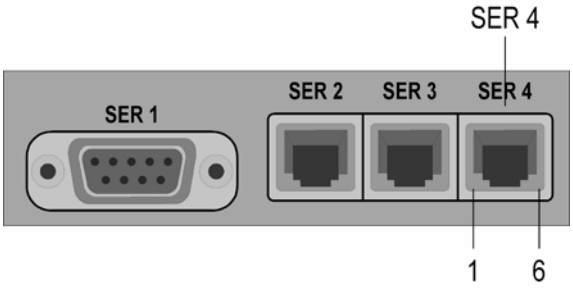


Table 12: (SER4) Connector Pinout for RS232 Configuration

Pin	Signal	Type	Function	Specifications
1	+5V_SW	V	Switched 5V Power Out Pin	+5V±10%; 500mA max. **Note:** This signal is simultaneously connected to the Power Out pins of all SER and EXT connectors. Switching this signal on/off causes enabling/disabling of all connected peripherals. A total of 700mA can be supplied by the terminal to all connected peripherals.
2	RTS (COM4)	O	Request To Send	EIA-RS232 level
3	TXD (COM4)	O	Transmit Data	EIA-RS232 level
4	RXD (COM4)	I	Receive Data	EIA-RS232 level
5	CTS (COM3)	I	Clear To Send	EIA-RS232 level
6	GND	G	Ground	

Table 13: (SER4) Connector Pinout for Internal Bluetooth Configuration

Pin	Signal	Type	Function	Specifications
1	+5V_SW	V	Switched 5V Power Out Pin	+5V±10%; 500mA max. **Note:** This signal is simultaneously connected to the Power Out pins of all SER and EXT connectors. Switching this signal on/off causes enabling/disabling of all connected peripherals. A total of 700mA can be supplied by the terminal to all connected peripherals.
2	NC		Not connected	
3	NC		Not connected	
4	NC		Not connected	
5	NC		Not connected	
6	GND	G	Ground	

USB Device Connector

Connector type: USB Type B.

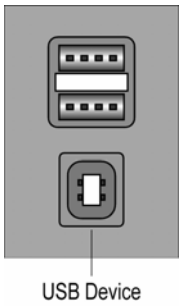


Table 14: (USB Device) Connector Pinout

Pin	Signal	Type	Function	Specifications
1	NC		Not connected	
2	D+	B	USB Data (+)	Universal Serial Bus Specification Rev 1.1.
3	D-	B	USB Data (-)	Universal Serial Bus Specification Rev 1.1.
4	GND	G	Ground	

USB Host Connectors

Connector type: Double USB Type A.

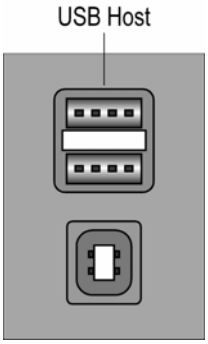


Table 15: (USB Host Slot 1) Connector Pinout

Pin	Signal	Type	Function	Specifications
1	+5V	V	5V Power Out Pin	+5V±10%; 500mA max. **Note:** A total of 700mA can be supplied by the terminal to all connected peripherals.
2	D+	B	USB Data (+)	Universal Serial Bus Specification Rev 2.
3	D-	B	USB Data (-)	Universal Serial Bus Specification Rev 2.
4	GND	G	Ground	

Table 16: (USB Host Slot 2) Connector Pinout

Pin	Signal	Type	Function	Specifications
1	+5V	V	5V Power Out Pin	+5V±10%; 500mA max. **Note:** A total of 700mA can be supplied by the terminal to all connected peripherals.
2	D+	B	USB Data (+)	Universal Serial Bus Specification Rev 2.
3	D-	B	USB Data (-)	Universal Serial Bus Specification Rev 2.
4	GND	G	Ground	

EXT1 Connector

Connector type: RJ11 4-pin Female.

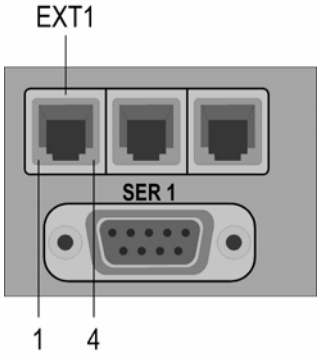


Table 17: (EXT1) Connector Pinout

Pin	Signal	Type	Function	Specifications
1	CANBus H	B	CAN High-Level Voltage I/O	CANBus Specification V2.0B
2	CANBus L	B	CAN Low-Level Voltage I/O	CANBus Specification V2.0B
3	EXT1_IN1 / High Speed Counter Input	I	Control Input/ High Speed Counter	CMOS Level 3.3V. 5V tolerant **Min** **Max** Input Low: VIL 0V 0.8V Input High: VIH 2.0V 5.5V Internal Line Termination Resistor 10 ohm
4	GND	G	Ground	

EXT2 Connector

Connector type: RJ11 4-pin Female

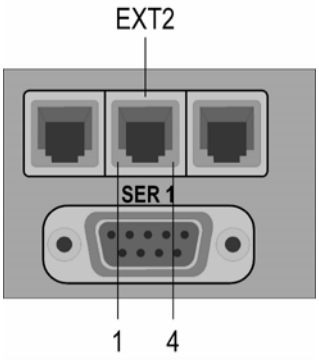
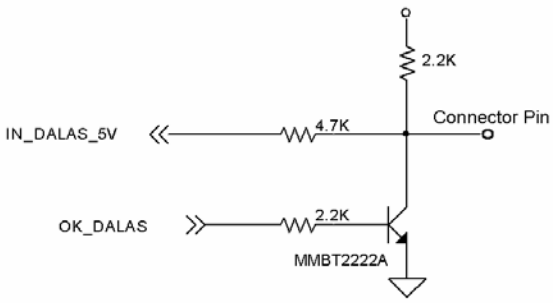


Table 18: (EXT2) Connector Pinout

Pin	Signal	Type	Function	Specifications
1	A/D Input1	I	Analog Input	0V-30V max, 12k OHM
2	IN / OUT / ID Button Port	I/O	One-Wire Interface. (DALLAS ID Button Interface) Port.	
3	GND	G	Ground	
4	A/D Input2	I	Analog Input	0V-30V max, 12k OHM

EXT3 Connector

Connector type: RJ45 8-pin Female.

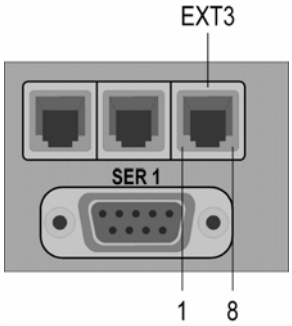


Table 19: (EXT3) Connector Pinout

Pin	Signal	Type	Function	Specifications
1	EXT3_IN1	I	Control Input/Counter	**Min** **Max** Input Low: VIL 0V 0.8V Input High: VIH 2.0V 5.5V
2	EXT3_IN2 / CARD DETECT	I	Control Input/ Card Detect (Card Reader Port)/Counter	Input Low: VIL 0V 0.8V Input High: VIH 2.0V 5.5V
3	EXT3_IN3 / CARD CLK 2	I	Control Input/ Clock Track 2 (Card Reader Port)/Counter	Input Low: VIL 0V 0.8V Input High: VIH 2.0V 5.5V
4	EXT3_IN4 / CARD DATA 2	I	Control Input/ Data Track 2 (Card Reader Port)	Input Low: VIL 0V 0.8V Input High: VIH 2.0V 5.5V
5	EXT3_IN5 / CARD CLK 1	I	Control Input/ Clock Track 1 (Card Reader Port)/Counter	Input Low: VIL 0V 0.8V Input High: VIH 2.0V 5.5V
6	EXT3_IN6 / CARD DATA 1	I	Control Input/Data Track 1 (Card Reader Port)	Input Low: VIL 0V 0.8V Input High: VIH 2.0V 5.5V
7	GND	G	Ground	Input Low: VIL 0V 0.8V Input High: VIH 2.0V 5.5V
8	+5V_SW	V	Switched 5V Power Out Pin	+5V±10%; 500mA max. **Note:** This signal is simultaneously connected to Power Out pins of all (SER) and (EXT) connectors. Switching this signal on/off causes enabling/disabling of all connected peripherals. A total of 700mA can be supplied by the terminal to all connected peripherals.

* All pins are at 3.3V. 5V tolerant CMOS Level.

GPS Antenna Connector

Connector type: MCX Female

GPS Antenna Performance Recommendations: Active, 3.3 VDC

WARNING!

When magnetic-mount or permanent-mount GPS antennas are installed on a metal source for prolonged periods, care must be taken to insulate the antennas in order to prevent galvanic corrosion or electrical damage.

Cellular Modem Antenna Connector

Connector type: SMA Female

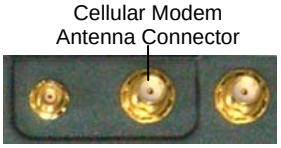


Table 20: GSM/GPRS Antenna Performance Recommendations

Frequencies		
GSM 850	TX	824 – 849 MHz
	RX	869 – 893 MHz
GSM 900	TX	880 – 915 MHz
	RX	925 – 960 MHz
DCS 1800	TX	1710 – 1785 MHz
	RX	1805 – 1880 MHz
PCS 1900	TX	1850 - 1910 MHz
	RX	1930 – 1990 MHz
Gain:	0 dBi (unity) gain or greater	
Impedance:	50 Ohm	
VSWR:	Typical: 1.5:1 Worst Case: 2.5:1	

WARNING

The wireless LAN antenna connector and the GPRS antenna connector on the back panel of the Net-960CE-S are both SMA connectors. Ensure that you connect the correct antenna to the correct connector.

Wireless LAN Antenna Connector

Connector type: SMA Female

Table 21: Wireless LAN Antenna Performance Recommendations

Frequency:	2400-2500 MHz
Gain:	2 dBi gain or greater
Impedance:	50 Ohm
VSWR:	Typical: 1.5:1

WARNING

The wireless LAN antenna connector and the GPRS antenna connector on the back panel of the Net-960CE-S are both SMA connectors. Ensure that you connect the correct antenna to the correct connector.

External Speaker Connector

Connector type: 3.5mm Mono Jack Female

Mono loudspeaker output: 1.1 W, 4-8 OHM

AV Connector

Connector type: RCA Phono Jack (Yellow) Female

Composite Video

PAL (ITU-R624-3) System

NOTE:

The quality of the cable connected to the external display may affect the quality of the picture. Use a braid and foil cable from a reputable company. Avoid the usage of poor quality cables.

Microphone Connector

Connector type: 2.5mm Mono Jack Female

Microphone performance recommendations:

- Electret microphone
- 2.2V Feeding source
- Resistance up to 2K

SIM Card Connector

Standard SIM card connector type

32K SIM

1.8V / 3.0V

Chapter 5

Net-960CE-S Installation

About This Chapter

This chapter describes the installation procedure of the Net-960CE-S device, including bracket mounting and electrical installation, as follows:

1 Determine the optimal positioning of the Net-960CE-S in the vehicle to enable access and a clear view.

2 Perform the mechanical installation of the Net-960CE-S on the mounting bracket, as described on page 59.

3 Perform the electrical preparation of the external devices to suit the Net-960CE-S communication cables, as described on page 61.

4 Connect all external devices and antennas.

5 Connect the Net-960CE-S's power.

Mechanical Installation

Mounting the Net-960CE-S MDT - Standard Model

The Net-960CE-S is supplied with a mounting bracket with eight 6.3mm (0.25”) holes prepared in advance for attachment to the vehicle’s dashboard.

1 Affix the bracket in the desired position using as many screws as required.

2 Align the round rubber mount on the right and left sides of the Net-960CE-S with one of the three holes provided on the sides of the bracket. Both sides should be aligned with the same hole, meaning either the top, middle or bottom hole on each side.

3 Attached the rubber side screws from the outside of each side of the bracket so that it goes through the bracket hole and screws into the rubber mount, which is attached to the Net-960CE-S. Screw it in firmly, but do not over-tighten.

Figure 6: Mechanical Installation – Standard Model

Mounting the Net-960CE-S MDT - Screenless Model

The Net-960CE-S screenless model has four tabs for the insertion and tightening of screws.

NOTE:

Ensure that the Net-960CE-S screenless model is attached to a flat surface.

Pay attention to mount it in such a way that you have access to both the SIM card slot and the configuration keys.

Figure 7: Mechanical Installation – Screenless Model

Electrical Installation

Prepare the power and communication cables in the vehicle as required by the Net-960CE-S model that you are installing, as determined by factory and application settings.

Connect the power and communication connectors to the terminal sockets.

Power Cable Wires

Use a 24AWG – 28AWG wire gauge to prepare the Net-960CE-S power cable, which can be up to 3 meters (118.11 inches) long.

Power Protection Fuse

The Net-960CE-S has no internal fuse. It should be connected to a power source line in the vehicle protected by 10A fuse. Additionally, a 4A fuse should be added to the power cable with an inline fuse holder for HHC/HHD blade-type fuses.

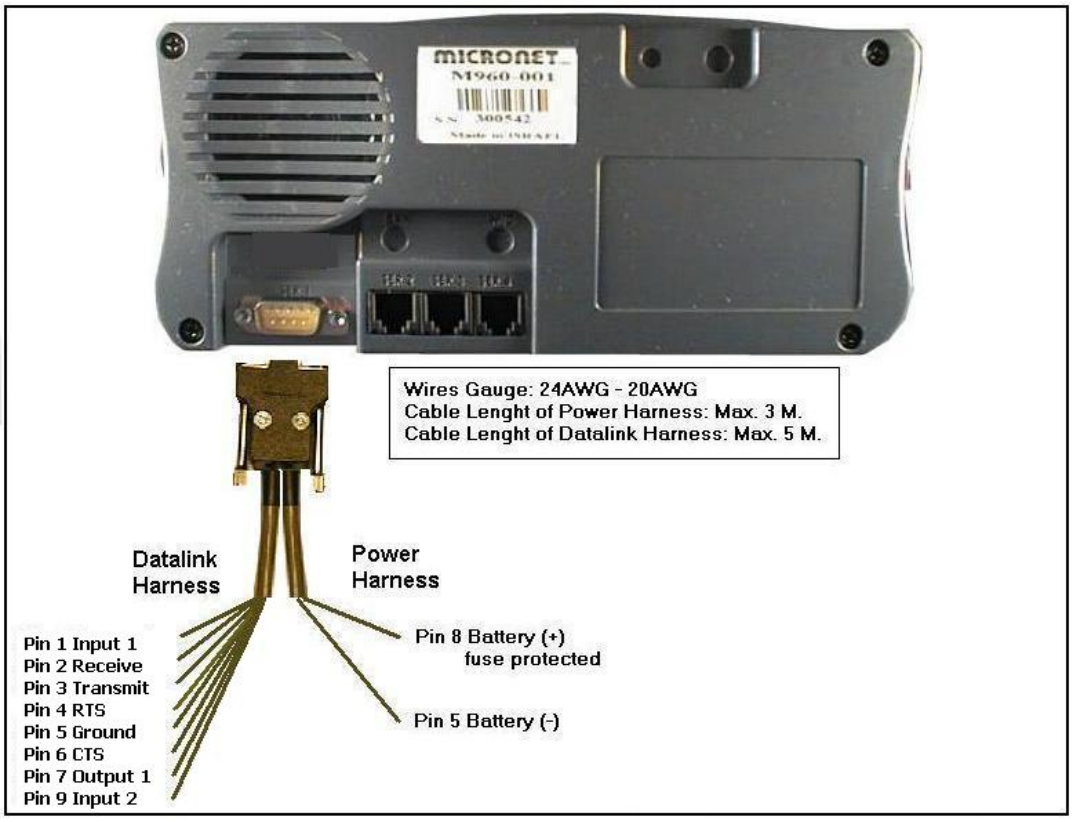


Figure 8: SER 1 Connector Wiring Scheme – Basic Configuration

Vehicle Ignition Switch Connection

To enable proper power management, it is recommended to connect the vehicle ignition switch to one of the three inputs in the SER1 port. In addition the application should monitor this input in order to determine when to turn the terminal on and off.

The figure shows the wiring scheme of the SER 1 Port.

Appendix A

Net-960CE-S Certifications

FCC ID: U8ONET960CE

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:
(1) This device may not cause harmful interference and
(2) This device must accept any interference received, including interference that may cause undesired operation.

This FCC ID belong to WiLAN configurations.

This family of products with GPRS confirguratins, contain FCC ID: IHDT56FV1.

The FCC Wants You to Know

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

a) Reorient or relocate the receiving antenna.

b) Increase the separation between the equipment and receiver.

c) Connect the equipment to an outlet on a circuit different from that to which the receiver is connected.

d) Consult the dealer or an experienced radio/TV technician.

FCC Warning

Modifications not expressly approved by the manufacturer could void the user authority to operate the equipment under FCC Rules.

Instructions concerning human exposure to radio frequency electromagnetic fields.

To comply with FCC Section 1.307 (b)(1) for human exposure to radio frequency electromagnetic fields, implement the following instruction:

A distance of at least 20cm. between the equipment and all persons should be maintained during the operation of the equipment.
The antenna installation must be co-located or operate in conjunction with any other antenna or transmitter.
The GPRS/GSM module contains 900 MHz GSM and 1800 MHz DCS functions that are not operational in U.S. Territories.