# Network Control Module 200 Series

<table>
<thead>
<tr>
<th>Engineering</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description</td>
<td>*3</td>
</tr>
<tr>
<td>Theory of Operation</td>
<td>*4</td>
</tr>
<tr>
<td>Design Considerations</td>
<td>*10</td>
</tr>
<tr>
<td>Components</td>
<td>*17</td>
</tr>
<tr>
<td>NCM Cable Guidelines</td>
<td>*20</td>
</tr>
<tr>
<td>Software Set Up</td>
<td>*30</td>
</tr>
</tbody>
</table>

## Commissioning Procedures

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overview</td>
<td>*33</td>
</tr>
<tr>
<td>Setting the N2 End-of-Line Switch</td>
<td>33</td>
</tr>
<tr>
<td>Installing the Submodules</td>
<td>*34</td>
</tr>
<tr>
<td>NCSETUP</td>
<td>*37</td>
</tr>
</tbody>
</table>

## Troubleshooting Procedures

<table>
<thead>
<tr>
<th>Issue</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>NCM Power Up</td>
<td>*39</td>
</tr>
<tr>
<td>Communications</td>
<td>*45</td>
</tr>
<tr>
<td>Related Commissioning Problems</td>
<td>51</td>
</tr>
<tr>
<td>Service</td>
<td>53</td>
</tr>
</tbody>
</table>

## Specifications and Order Codes

<table>
<thead>
<tr>
<th>Type</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Specifications</td>
<td>*55</td>
</tr>
<tr>
<td>Ordering Information</td>
<td>*56</td>
</tr>
</tbody>
</table>

* Indicates those sections where changes have occurred since the last printing.
The 200 Series Network Control Module (NCM200) is the main processing module in the Network Control Unit (NCU). Fully programmable, the NCM200 coordinates and supervises the control activities for all objects and control loops hardwired to the NCU, as well as the remote Network Expansion Units (NEUs) and Application Specific Controllers (ASCs) connected to it over a local bus.

An NCM200, via the N1 Local Area Network (N1 LAN), also has the ability to control activities for objects located in other NCMs. An example of exchanged control would be objects shed or restored by the Demand Limiting/Load Rolling feature.

Different program sets download to an NCM200 to support a variety of devices on its local buses. The program sets are of two types: Standard Functionality and Migration Functionality. The Standard Functionality supports one of the following applications:

- **Standard NCM** software supports the following: NEUs, Heating, Ventilating, and Air Conditioning (HVAC) Applications such as Air Handling Unit (AHU) Controllers, Variable Air Volume (VAV) Controllers, VAV Modular Assemblies (VMA), Unitary (UNT) Controllers, Lab and Central Plant (LCP) Controllers, DX-9100/9120, and Application Specific Controllers (ASCs) on the N2 Bus, plus C210/C260 controllers on an L2 Bus.

- **Fire Management** software integrates the fire and safety IFC-1010/2020 controller to Metasys®, as well as supporting Point Multiplex Modules (XMs) and HVAC ASCs on the N2 Bus.

- **Intelligent Access Controller** software integrates the access IAC-600 Controller to Metasys, as well as supporting XMs and HVAC ASCs on the N2 Bus.

- As an alternative to the Network Terminal (NT), Operator Terminal (OT) software connects a VT100, or a Personal Computer (PC) with VT100 emulation software to the NCM200. An NCM with an Operator Terminal connected supports NEUs, Intelligent Lighting Controllers (ILCs), and ASCs, including the LCP.

In addition, an Operator Terminal connected to one NCM on the N1 network can display, schedule, and control Fire, Access, S2, or L2 Bus applications connected to other NCMs on the network.
The Migration Functionality program set builds pathways from the NCM200 to other systems. While it can support any of the Standard Functionality program sets described earlier, Migration Functionality can also connect one of the following applications to Metasys:

- *S2 Migration* software brings JC/85 field gear, object information, and control directly into Metasys from the JC/85 trunks.

- *JC/85 Gateway* allows Metasys object information to integrate with the JC/85 Central Processing Unit (CPU). In the Gateway application, the NCM serves as a high-level protocol translator, making Metasys object information available to a JC/85 headend.

- The *Network Port* application lets you monitor and control the Metasys system from a third-party host. The host computer must be able to communicate with an ALLEN-BRADLEY PLC-5® (Programmable Logic Controller). The host, in turn, communicates with the Network Port, which emulates some features of a PLC-5.

Note: For complete information about the Network Port, refer to the *Network Port Technical Bulletin (LIT-6295050)* in the *Metasys Connectivity Technical Manual (FAN 629.5)*.

The NCM200 is a microprocessor-based intelligent node in the Metasys Network. It integrates three streams of information:

- system and data base information
- application programs
- data and I/O information arriving from the communication ports

*Figure 1* illustrates the basic components and functions of the NCM200.
A Network Identity Module (NIM) (Item 1 in Figure 1) is a submodule that configures features and data base capacity for the NCM200. The NIM206 covers all applications supported by previous NIMs. When replacing an NIM (for example, an NIM102), use the NIM206. The NIM206 is factory installed in the NCM201.

**Figure 2: Network Identity Module (NIM)**

The microprocessor (Item 2 in Figure 1) applies the various supervisory programs to the combined data, and controls the modules and devices that connect to the NCM via a local bus.

This supervision and control operates in the same manner when any of the Standard Functionality program sets (standard, fire management, intelligent access control, or Operator Terminal) are downloaded.

For the Migration Functionality program set, the microprocessor translates data from the field gear into compatible code for the target system:

- For S2 Migration, the microprocessor integrates the incoming S2 data into Metasys and extends NCM supervisory and control functions over the objects on the S2 trunk.

- For JC/85 Gateway, the NCM microprocessor:
  - executes commands from the JC/85 headend to objects on the Metasys side
  - provides attribute information for all objects on the Metasys side
  - translates and sends Metasys reports to the JC/85 devices
• In Network Port applications, the microprocessor:
  - translates the host-generated requests to Metasys commands
  - applies the various supervisory programs to the combined data, supporting those functions that relate to the mapping of data objects to the host computer (mapped analog data and binary data objects)

All the software applications and supervisory routines take place inside the NCM; data base exceptions and historical files are uploaded to the Operator Workstation (OWS) (Item 3 in Figure 1) for reporting and archival purposes.

Communications

The I/O subsystem supports a multi-user environment consisting of integrated network connections (N1 and N2), submodule ports, and direct I/O communication (NT [or Operator Terminal], RS-232).

N1 Local Area Network

N1 LAN communication is provided by the built-in N1 interface (Item 4 in Figure 1) terminating at a BNC connector at the bottom of the NCM200 module.

The N1 LAN is composed of the standard ARCNET® chip set and hardware, allowing communication with both OWSs and other NCMs.

Each NCM and OWS on the system contains a “node manager” task, whose responsibilities include:

• broadcast once per minute that it is still online
• listen to other node managers to track on and offline trunks
• issue a time stamp for every global data base in its memory
• compare the time stamps of its own data bases to the received time stamps of other node managers’ data bases, and update the current data base if necessary
• monitor the printer for online or offline status

The node with the lowest address number on the system issues time and date information once per day to ensure system synchronization. Time and date information is backed up by a clock/calendar chip (Item 5 in Figure 1). The node manager also monitors broadcasts and issues online/offline advisories.

In the event of a severed N1 network, each separated LAN forms an independent network.
Local Bus: N2

The N2 Bus communications are also provided by a built-in interface (Item 6 in Figure 1). Devices on the N2 Bus constitute a local network, controlled by the NCM. The NCM polls the devices according to a user-set priority level, which is set at each device’s definition window.

The N2 connects in a daisy chain fashion, and provides the transmission medium for modules installed within the base frame (e.g., a Digital Control Module or Point Multiplex Module), as well as the external devices (application specific controllers—including the IFC-1010/2020 Intelligent Fire Controller and IAC-600 Intelligent Access Controller). External devices connect to the N2 interface via the Terminal Communications Board (TBC) (Item 7 in Figure 1).

An NCM200 can accept both N2 and L2 communications at the same time when using the Standard NCM software (not fire management, intelligent access, or OT software).

Note: Starting with Metasys Release 6.0, a second N2 Bus can be added using an N2 submodule connected to the NCM’s Communication Submodule slot (Item 8 in Figure 1). For complete information, see the Dual N2 Bus Application Note (LIT-6363145).

Local Bus: L2

The optional L2 Bus is dedicated to connecting C210A and C260A ASCs on a local, external trunk, controlled by the NCM. L2 communications are enabled by installing an L2 submodule in the NCM’s Communication Submodule slot (Item 8 in Figure 1).

The L2 Bus connects in a daisy chain fashion. As is the case with the N2 Bus, connections from the external lines to the NCM are made at the Communications Terminal Board. The devices on it are polled with equal priority.

An NCM200 can accept both N2 and L2 communications at the same time when using the Standard NCM software (not fire management, intelligent access, or OT software).

Submodules

Submodule slots (Items 8 and 10 in Figure 1) on the NCM allow users to plug in submodules to add or change functions to the system.

The Network Identity Module slot (Item 9 in Figure 1) is reserved for NIMs to configure the NCM200. An NIM module must be installed for the NCM200 to operate.

The Battery Submodule slot (Item 10 in Figure 1) is reserved for the battery submodule, which allows the NCM to retain code and data base memory for up to 72 hours in event of a power failure.
The Communications Submodule slot (8) allows installation of one of the following submodules to provide different communications options:

- the L2 submodule, to integrate a C210 or C260 controller to Metasys
- the N2 submodule for connection to a second N2 Bus to integrate N2 devices. See the Dual N2 Bus Application Note (LIT-6363145) for details.
- an internal modem submodule, to connect to remote operator devices such as a printer or OWS
- an RS-232C submodule, connecting to a printer, external modem, S2 Migration Trunk, JC/85 Trunk, Operator Terminal, or directly connected OWS

The RS-232C submodule is also the means by which you connect Metasys to a host system in the Network Port application. Refer to the Network Port Technical Bulletin (LIT-6295050) in the Metasys Connectivity Technical Manual (FAN 629.5).

**RS-232 Submodule: S2 Migration**

S2 communications are made via an RS-232 submodule on the NCM200 to a Table Top Modem (TTM). The TTM then interfaces with the JC/85 trunk.

- The S2 parameters are identical to those of the JC/85 trunks.
- S2 Migration connections from the submodule to other devices on the N1 LAN are identical to those of a Standard Functionality NCM200.
- The S2 Migration NCM does not accept a second submodule for a local L2 Bus, or other devices via the integrated N2 Bus.
- For S2 Migration applications that require a dial-up port, you must use the NCM401 instead of the NCM200.

**RS-232 Submodule: Gateway to JC/85**

The RS-232 connection on the JC/85 headend connects directly into the RS-232 submodule on the Gateway NCM.

- The Metasys objects on Gateway are connected from throughout the Metasys Network via the N1 LAN in the same manner as a Standard Functionality NCM200.
- The Gateway NCM does not accept a second submodule for a local L2 Bus, or other devices, via the integrated N2 Bus.
RS-232 Submodule: Operator Terminal

When using the Operator Terminal (OT) program set, the VT100 (or PC with VT100 emulation software) connects to the NCM via the RS-232 submodule, replacing the use of the Network Terminal. (Instead of connecting to the RS-232 port, an OT can connect to the NT Port. However, only one OT can be connected at a time.)

An Operator Terminal provides a higher level of capability than the Network Terminal, allowing you to read and write to each attribute of a Control System (CS) object, as well as define and build data bases for the Trend and Totalization features. Refer to the Operator Terminal Technical Bulletin (LIT-636015).

Note: When an Operator Terminal connects to an NCM through either the submodule (Port 2) or the NT Port (Port 4), the integrated RS-232 port (Port 3) will also support an unconfigured OWS. An example of this situation is using a laptop computer to download software into the NCM.

Additional I/O Support

The Network Terminal Port (Item 11 in Figure 1) supports a connection from the Network Terminal Unit or Operator Terminal to provide local operator I/O. The RS-232C Port (Item 12 in Figure 1) provides a connection to a local workstation or printer.

Power Up Conditions

The NCM powers up in either a cold start condition or a warm start condition. In the cold-start condition, the NCM automatically requests the OWS to download the code and data base information into the NCM’s memory. Refer to the Operator Workstation User’s Manual (FAN 634). In a warm start condition, the code and data base are stored in memory; the NCM is immediately and fully operational following the initial diagnostic tests.

By retaining memory during a power cycle, the battery backup provides a warm start condition when power returns to the NCM.

A System Reset button (Item 13 in Figure 1) manually resets the NCM under cold start conditions, which generates a request for code and data download.
Design Considerations

Replacing an NCM401 with an NCM200

Note: For S2 Migration applications that require a dial-up port, you must use the NCM300/350 instead of the NCM200.

Since Port 1 of the NCM200 is always the built-in N2, the S2 trunk must be moved from Port 1 on an NCM401 to Port 2 on the NCM200.

1. Remove any configured devices from Port 2 from the Global Data Definition Language (DDL) file.
2. Move the S2 trunk from Port 1 to Port 2 in both the Global DDL file and the NC DDL file.
3. After recompiling the NC and Global DDL files, all Graphic Programming Language (GPL) and JC-BASIC processes must be translated.

Note: If objects have been added online, these will be lost when you recompile the NC file. To avoid losing these objects, first perform a decompile (using UNDDL), and then make the port changes to the decompiled file.

Mounting

Mount the NCM200 into a standard 1-slot NCU, into Slot 2 of a 2-slot NCU, or into Slot 3 of a 5-slot NCU (Figure 3). Make sure to terminate the N1 cable to the BNC connector at the bottom of the NCM200 module.

Figure 3: Mounting the NCM200 into a Standard 1-Slot, 2-Slot, or 5-Slot Base Frame
In addition, a simpler, streamlined version of the base frame is available for the N1 direct-connect NCM (NCM200). This NCM-only base frame (Figure 4) is for applications that require the NCM200’s supervision and control over local trunks, but does not require direct wiring to field devices, or the flexibility of interchanging other electronic modules. Migration applications, for example, could be installed into the NCM-only base frame since they are not used to communicate with DCMs or XMs, and have no field devices connected to the NCU.

Figure 4: Mounting the NCM200 and Power Supply in the NCM-Only Base Frame (BSF121)
Software Configurations

NCM200 requires Release 4.0 or higher of the Metasys software.

**S2 Communications Tuning Parameters Modified for Telephone Lines**

Due to timing delays over telephone lines, some trunk configurations may require modification of the following S2 Communications parameters (using NCSETUP) in order to bring the field gear online:

1. Delay between polls to field devices
2. The polling timeout delay
3. The number of polling retries

See the *NCSETUP for Windows Technical Bulletin (LIT-6360251d)* for information on changing these parameters.

**Directly Connectable Hardware for Each Software Type of NCM**

The *NCM Software Options Technical Bulletin (LIT-636023)* in the Control Modules section of the *Metasys Network Technical Manual (FAN 636)*, describes which Metasys hardware devices function, for each type of downloadable software, when connected to that NCM. Please refer to it for the latest software options.

**NCM Capacity**

The NIM206 is the only NIM now used. When replacing any NIM, order the NIM206. For reference when using existing NIMs, the data base capacity for a NIM102/202 = 300K; NIM104/204 = 600K; and the NIM106/206 = 1200K.

**Standard Functionality: Standard NCM**

The load capacity for an NCM depends on the available memory determined by the installed NIM, in addition to the software configuration of the connected devices.

Refer to the *Network Control Unit/Network Expansion Unit Technical Bulletin (LIT-636020)* for information about the object loading of the individual electronic modules connected to the NCM via the base frame.

**Standard Functionality: Fire Management**

Along with the Release 4.0 or higher Metasys software needed for the NCM200, the fire management software requires the IFC-2020 Release 3.0 or higher firmware. A fire NCM handles one IFC-1010/2020 controller with up to 240 fire zones attached to that controller. Each zone counts as one object for the purpose of memory sizing.
The following guidelines list other kinds of devices that the fire management NCM is capable of processing:

- HVAC ASCs (AHUs, VAVs, VMAs, UNTs, PHXs, LCPs, DX-9100s, etc.)
- Point Multiplex Modules (XM) (Multiplex Binary, Multiplex Relay Latched, Multiplex Relay Momentary, Multiplex Relay Electrically Maintained)

The IFC is a building fire management controller, and in most situations it is alone on the NCM. However, if there are a few remaining ASC or XM points that do not justify a separate NCM, they can be added to an NCM supporting the IFC, up to the memory limits of that NCM.

**Standard Functionality: Intelligent Access Control**

The Intelligent Access Control (IAC) software requires Release 4.0 or higher Metasys software and IAC-600 Release PS130B firmware. For Metasys Release 6.0, the IAC NCM handles one or two IAC-600 controllers and up to 16 readers attached to each controller. (Prior to Release 6.0, the IAC NCM handles one IAC-600 controller and up to 16 readers attached to that controller.)

The following guidelines list other kinds of devices that the intelligent access control NCM is capable of processing:

- HVAC ASCs (AHUs, VAVs, VMAs, UNTs, PHXs, LCPs, DX-9100s, etc.)
- Point Multiplex Modules (XM) (Multiplex Binary, Multiplex Relay Latched, Multiplex Relay Momentary, Multiplex Relay Electrically Maintained)

The IAC-600 is a building access controller, and in most situations it is alone on the NCM. However, if there are a few remaining ASC or expansion module points that do not justify a separate NCM, they can be added to an NCM supporting the IAC-600, up to the memory limits of that NCM.

**Standard Functionality: Operator Terminal**

The Operator Terminal NCM has a load capacity similar to that of the standard NCM, including support of the Intelligent Lighting Controller (ILCs) and Lab and Central Plant Controller.

It differs from the standard NCM in that it replaces the Network Terminal, and does not support the DSC-1000 family of controllers (i.e., C210A, C260A, C260X, C500X) connected to the same NCM.

An Operator Terminal NCM may, however, interact with DSC-1000 controllers if they are connected to another NCM on the N1 LAN.
**Migration Functionality: Gateway**

An NCM200 with a 200 series NIM and Gateway software can connect one gateway trunk (via the RS-232 submodule) and map up to 1400 JC/85 Level 3 points. This trunk requires a dedicated RS-232 port on the JC/85 headend. An NIM206 handles the largest JC/85 data base allowed.

**Migration Functionality: Network Port Application**

See the *Network Port Technical Bulletin (LIT-6295050)*.

**Migration Functionality: S2 Migration**

An NCM200 with a 200 series NIM and S2 software can connect one JC/85 trunk through one Table Top Modem (for example, if four trunks were originally connected to the JC/85 headend, four NCMs are required unless the trunks can be reconfigured). The data base size of each trunk can be calculated with the *NCM Memory Estimator*.

The following are countable JC/85 objects:

- FPU device
- FPU hardware points (the SST101 counts as two objects)
- DSC-8500 device
- DSC-8500 hardware points
- DSC-8500 data points
- DSC-8500 status variables

In addition to the memory required by the object count and Metasys standard features, also calculate additional memory used for written programs of GPL equivalents to JC/85 features. See *How to Use the Metasys GPL HVAC Library (LIT-636121)*, under the App. Notes: GPL HVAC Library tab of the *Metasys Network Technical Manual (FAN 636)*.

Applications of interest to JC/85 users are:

- interlocks
- computed points
- chiller sequencing

Application notes exist for each of these processes in *Volume IV* of the *Metasys Network Technical Manual (FAN 636)*.

Among the considerations about adapting JC/85 code to Metasys, here are a few that may adjust the memory requirements:

- **Auto Shutdown**

  When converting JC/85’s Auto Shutdown feature to Metasys, write an equivalent GPL process for Metasys and add the file object size to the NCM’s memory usage.
- **ESO (Enthalpy Switch Over)**

  When converting the JC/85 ESO feature to Metasys, you must choose one of the four economizer features utilized in Metasys. Details and specifications about each of these programs are listed in *How to Use the Metasys GPL HVAC Library (LIT-636121)*.

  - ECONEN Comparison Enthalpy Economizer
  - ECONOE Outdoor Air Enthalpy Economizer
  - ECONDB Outdoor Air Dry Bulb Economizer
  - ECONRA Differential Temperature Economizer

**Table 1** shows applications and port restrictions when installing submodules into an NCM200 with a Standard Functionality software set downloaded (standard, fire management, intelligent access control, OT).

<table>
<thead>
<tr>
<th>Connection</th>
<th>Maximum Concurrent Connections</th>
<th>Port 1 (RS-485)</th>
<th>Port 2 (Dial)</th>
<th>Port 3 (Laptop)</th>
<th>Port 4 (NT)</th>
</tr>
</thead>
<tbody>
<tr>
<td>N2</td>
<td>2</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>L2</td>
<td>1</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>S2</td>
<td>1</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>JC-85 Gateway</td>
<td>1</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Network Port</td>
<td>1</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OWS-Direct (configured)</td>
<td>2</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>OWS-Dial</td>
<td>1</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>OWS (unconfigured)</td>
<td>1</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NT</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>NT-Emulator</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>OT</td>
<td>1</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>OT-Dial</td>
<td>1</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>NC Printer</td>
<td>2</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NC Printer-Dial</td>
<td>1</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N1 – ARCNET</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ethernet</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum Speed</td>
<td>--</td>
<td>19.2K</td>
<td>19.2K</td>
<td>19.2K</td>
<td>19.2K</td>
</tr>
</tbody>
</table>

Notes:

1. The L2 Bus connection requires an L2 submodule.
2. Direct connection is recommended on Port 3 for the OWS. This allows connection to systems locally.
3. Download from remote OWS is only available on the NCM350/361.
4. Use of the Operator Terminal replaces the Network Terminal and disables the NT port.

Continued on next page . . .
Notes: (Cont.)

5 The maximum number of connections of that type on the NCM. For example, there can be two N2 connections on the NCM, on Ports 1 and/or 2. There can be one OWS Dial connection on the NCM, on Port 2, 3, 5, or 6.

6 Use RS-232 cable to connect devices to the integrated RS-232 port. Connections at the integrated ports are independent of each other; for example, a printer can be connected to both ports at the same time. An RS-232 submodule is required for these connections.

7 Dial-up printer, OWS, or OT connected to phone line via a modem.

8 A configured OWS is an OWS that is defined in the data base.

9 N2 Bus can connect to this port via an RS-232 to RS-485 converter.

10 An unconfigured OWS is not defined in the data base (for example, a laptop computer). It can be used to run logs and summaries, or to download a data base. They cannot be connected directly to the Ethernet LAN.

11 Either an NT or an OT directly connects to the RJ-12 port via the NT Emulator cable.

12 An OT, or a PC with NT Emulator software, connects directly to the RS-232 port via RS-232 cable.

Table 2 illustrates applications and port restrictions when installing submodules into an NCM200 with one of the Migration Functionality software sets downloaded (for the Network Port Application, see the Network Port Technical Bulletin, LIT-6295050).

Note: When installing a Migration NIM, you have the option of loading any of the Standard Functionality software sets instead of a Migration software set.

Table 2: Migration Functionality NCM200 Serial Port Configuration

<table>
<thead>
<tr>
<th>Port</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>NT Port</td>
<td>Network Terminal directly connects via the NT cable.</td>
</tr>
<tr>
<td>Integrated RS-232 Port</td>
<td>All devices connect to the integrated RS-232 port via an RS-232 cable.</td>
</tr>
<tr>
<td>(Port 3)</td>
<td>Configured OWS (i.e., defined in the data base)</td>
</tr>
<tr>
<td>Printer</td>
<td>Unconfigured OWS (i.e., not defined in the data base): An example would be a laptop computer. May be used to run logs and summaries, or to download a data base.</td>
</tr>
<tr>
<td>Communications Submodule Port</td>
<td>S2 Migration, connected via RS-232 submodule to JC/85 trunk via Table Top Modem.</td>
</tr>
<tr>
<td>(Port 2)</td>
<td>JC/85 Gateway, connected via RS-232 submodule to JC/85 headend. (Connection may alternately be via a high-speed modem over a dedicated phone line.)</td>
</tr>
</tbody>
</table>

Note: JC/85 Gateway: To send the NCM print file to the JC/85 printer, define the printer as “Port 2” (the communications submodule slot—the same port definition as you assign to Gateway). To print to a printer connected directly to the NCM200, connect the printer into the RS-232 port (Port 3—the integrated port).
Figure 5 illustrates the ports and submodule positions on the NCM.

L2 Submodule

The L2 submodule provides compatible signals for a DSC-1000 L2 Bus (C210 and C260 controllers). The L2 submodule inserts in only one orientation. There is one switch to set on the L2 submodule:

**Channel A/B Switch:** Indicates which terminal blocks the L2 connects to on the communication panel. Set to Channel B, corresponding with the TB2 terminals on the TBC.

N2 Submodule

For applications requiring a second N2 Bus, use the N2 submodule, which provides compatible signals for N2 devices. For complete information, see the Dual N2 Bus Application Note (LIT-6363145) in this manual.

The N2 submodule inserts in only one orientation. There are two switches to set on the N2 submodule:

**Channel A/B Switch:** Indicates which terminal blocks the N2 connects to on the communication panel. Set to Channel B, corresponding to the TB2 terminals on the TBC.

**End-of-Line (EOL) Switch:** Indicates whether the NCM is one of the two EOL devices on the N2 bus. Setting the N2 EOL to In means the NCM is EOL. Out means that other modules are daisy-chained (in the backplane) both upline and downline of the NCM.

RS-232 Submodule

The RS-232 submodule provides input/output at standard RS-232C levels. The RS-232 submodule inserts in only one orientation.

There are no switches to set. However, because of the recessed connector on the NCM, a special right-angle cable with a narrow profile shell is required to attach to the RS-232 submodule. One end of this cable (NU-CBL101-0) arrives pigtailed.
The user connects the pigtailed wires into a separately ordered hood, either male (MHK101) or female (FHK101), according to the pinout requirements.

**Internal Modem Submodule**

The internal modem is Hayes® compatible, with the baud rate automatically configuring to either 300 bps or 1200 bps. The module inserts in only one orientation. This modem is compatible with the Metasys Network and resides within the NCM. An external modem (Hayes compatible) may be preferred if faster communication rates or different performance characteristics are needed. Connecting an external modem requires the use of the RS-232 submodule.

There are no switches to set on the internal modem. Two phone jacks are evident on the module face. The phone line connects to the upper jack marked Line. A telephone handset can be connected into the lower jack marked Handset.

**RJ-12 Network Terminal Port**

The Network Terminal plugs into this 6-pin telephone jack, which supports Transmit, Receive, and Data Terminal Ready lines. There are no switches to set on this built-in port.

This port is non-functional when the Operator Terminal software set is downloaded. The NT port does not support the Zone Bus Terminal.

⚠️ **CAUTION:** Do not plug a phone line into the NT port. Plugging a phone line into the RJ-12 port may damage the port and render it unusable.

**RS-232C Port**

There are no switches to set on the built-in RS-232C port (Port 3), which is used to support a local OWS or local printer. All RS-232 connections to third-party equipment must be made with shielded cable. A typical application may utilize the built-in RS-232 port in addition to the RS-232 submodule, for a total of two RS-232 connections.

**Battery Submodule**

The battery submodule automatically recharges from the NCM, and maintains Random Access Memory (RAM) programs and data bases for up to a 72-hour power failure. The module installs in the field and inserts in only one orientation. There are no switches to set.

**Table Top Modem**

The TTM-10n Table Top Modem provides an interface between the RS-232 submodule on the S2 Migration NCM and one JC/85 communications trunk. A TTM-10n modem consists of an external power supply, a circuit board with enclosure, and one master modem card. Three models (and one alternative) of the TTM-10n are available:
TTM-101 Provides the interface necessary to communicate to a 18 AWG proprietary, shielded, twisted-pair trunk. A TRM-101 comes mounted to the printed circuit card, and is available for single-trunk applications only.

TTM-102 Provides the interface necessary to communicate to a dedicated leased type 3002 phone line. A DPM-101 comes mounted to the printed circuit card.

TTM-103 Provides the interface necessary to communicate on a JC/LINK Generic Bridge. The Rolm bridge version is not available.

MDM-101 (UDS-202) An alternative modem to interface between an RS-232 submodule from the S2 NCM and a remote MDM-101 (outside vendor modem would be the UDS-202) over a voice-grade type 3002 leased phone line.

Printers

The printers are not a component of the NCM200. However, the specific printer models approved for the NCM200 are the IBM® Proprinter III™ and the Lexmark™ Model 2380 (set to emulate an IBM Proprinter III).

Notes: Smoke control applications require a printer connection to the NCM. If the Fire OWS is not being used, a UL Listed PRN-3/4 printer must be connected directly to at least one UL Listed NCM200/201-0 or NCM300/350-2 running the smoke control algorithm and the NCM must be configured as “NC Direct.”

Figure 19 illustrates the pinout connections to the NCM’s integrated RS-232 port or RS-232 submodule.

To properly configure the printer for the NCM200, use the individual printer instructions as a guide to set the mode and DIP switches to the following configurations:

- Card: Serial Interface
- Mode: RS-232
- Polarity: No reverse polarity (typically--this setting could change, depending on the individual computer system and cabling.)
- Baud Rate: Set to the rate established in DDL. Default is 9600.
- Data Bits: 8
- Parity: No
- Stop Bits: 1
- Protocol: XON/XOFF
- Operation: Normal

Cable connections are illustrated in the following section, *NCM Cable Guidelines*. 

---

*Control Modules—Network Control Module 200 Series*
This section starts by illustrating the N1 LAN connections for new and retrofit applications. N2 cabling to the communications terminal board is described in the *Network Control Unit/Network Expansion Unit Technical Bulletin (LIT-636020)*, and the *N2 Communications Bus Technical Bulletin (LIT-636018)*.

This section then organizes cable connections by device (such as by OWS, printer, etc.) and finally by migration type (Gateway or S2). Devices connecting to both the RS-232 submodule and the integrated RS-232 port show two cables, since the pinouts for those connections are different.

### Using the NCM-Only Base Frame

Connect the N1 cable via a T-connector to the bottom of the NCM200 module, as shown in [Figure 6](#). Ensure that no metal part of the connection (EOL cap, T-connector, or exposed metal part of the cable) is touching a case or any metal on the base frame. Black tape, or a clip-on plastic shroud, will protect the metal from inadvertent contact.

1. Add terminal cap or continue N1 LAN at left side of "T."
2. Apply black tape or plastic shroud around metal connections.

![Figure 6: Making N1 LAN Connections Using NCM-Only Base Frame](#)
**Using Standard Base Frames**

Figure 7 illustrates the method of connecting the N1 LAN to the NCM200 in applications that install the NCM200 in a standard 1-slot, 2-slot, or 5-slot base frame (e.g., a retrofit application). Remove the incoming and outgoing N1 cables from the TBC. Attach a female barrel connector to each cable end. Then add an extension cable from the incoming N1 cable to a T-connector at the bottom of the NCM200 module. Add a second extension cable backup to the outgoing N1 cable (if a terminator cap is used, cap the outgoing side of the T-connector). The extension cable must be the same type as the main N1 cable. Apply the same precautions for inadvertent metal contact as described for Figure 6.

---

**Figure 7: Method to Make NCM200 N1 LAN Connections Using Standard Base Frames**
Attaching to either the NCM’s RS-232 submodule or RS-232 port is a special right-angle cable with narrow profile shell (NU-CBL101-0). The user connects the pigtailed wires of this cable into a separately ordered hood, male (MHK101) or female (FHK101), according to the pinout requirements of the user’s device. The wire configuration of NU-CBL101-0 is diagrammed in Figure 8.

**Figure 8: Pinouts for NU-CBL101-0**

<table>
<thead>
<tr>
<th>NU-CBL101-0</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
</tr>
<tr>
<td>2</td>
</tr>
<tr>
<td>3</td>
</tr>
<tr>
<td>4</td>
</tr>
<tr>
<td>5</td>
</tr>
<tr>
<td>6</td>
</tr>
<tr>
<td>7</td>
</tr>
<tr>
<td>8</td>
</tr>
<tr>
<td>18</td>
</tr>
<tr>
<td>20</td>
</tr>
</tbody>
</table>

**Figure 9: IBM PC Serial Port of OWS Connected to the NCM RS-232 Submodule**

<table>
<thead>
<tr>
<th>NCM RS-232 Submodule</th>
<th>IBM PC Serial Port (Female, FHK101)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Out 2</td>
<td>FG Black</td>
</tr>
<tr>
<td>In 3</td>
<td>RD Brown</td>
</tr>
<tr>
<td>Out 4</td>
<td>RTS Red</td>
</tr>
<tr>
<td>In 5</td>
<td>CTS Orange</td>
</tr>
<tr>
<td>In 6</td>
<td>DSR Yellow</td>
</tr>
<tr>
<td>7</td>
<td>SG Green</td>
</tr>
<tr>
<td>8</td>
<td>DCD Blue</td>
</tr>
<tr>
<td>Out 18</td>
<td>DCE DCD Violet</td>
</tr>
<tr>
<td>Out 20</td>
<td>DTR White</td>
</tr>
</tbody>
</table>
OWS to the NCM RS-232 port:

### Figure 10: IBM PC Serial Port of OWS Connected to the NCM RS-232 Port

#### Compaq/Portable OWS Cabling

The Compaq® computer and portable OWS use the same cable configuration. Both require an additional converter cable, as shown below, when connected to the NCM RS-232 submodule.

### Figure 11: Compaq or Portable OWS Connected to the NCM RS-232 Submodule
When connecting to the NCM RS-232 port, the Compaq computer, and Portable OWS, use the same cable configuration. Both require an additional converter cable, as shown in Figure 12.

<table>
<thead>
<tr>
<th>NCM RS-232 Port</th>
<th>Female FHK101</th>
<th>Male 25-pin</th>
<th>PC Serial Port Female 9-pin</th>
</tr>
</thead>
<tbody>
<tr>
<td>FG</td>
<td>FG</td>
<td>FG</td>
<td>Shell</td>
</tr>
<tr>
<td>In 2 FG</td>
<td>FG</td>
<td>FG</td>
<td>Shell</td>
</tr>
<tr>
<td>In 2 RD</td>
<td>TD</td>
<td>Out 2</td>
<td>DCD</td>
</tr>
<tr>
<td>Out 3 RD</td>
<td>TD</td>
<td>In 3</td>
<td>RD</td>
</tr>
<tr>
<td>In 4 CTS</td>
<td>RTS</td>
<td>Out 4</td>
<td>TD</td>
</tr>
<tr>
<td>Out 5 RTS</td>
<td>CTS</td>
<td>In 5</td>
<td>DTR</td>
</tr>
<tr>
<td>Out 6 DTR</td>
<td>DSR</td>
<td>In 6</td>
<td>SG</td>
</tr>
<tr>
<td>7 SG</td>
<td>SG</td>
<td>7 DSR</td>
<td>DSR</td>
</tr>
<tr>
<td>Out 8 DCE DCD</td>
<td>DCD</td>
<td>8 DCE DCD</td>
<td>RTS</td>
</tr>
<tr>
<td>18 DCD</td>
<td>Unused</td>
<td>18 DCD</td>
<td>CTS</td>
</tr>
<tr>
<td>In 20 DTR</td>
<td>DTR</td>
<td>20 DTR</td>
<td>9</td>
</tr>
</tbody>
</table>

**Figure 12: Compaq or Portable OWS Connected to the NCM RS-232 Port**

**Operator Terminal Cabling**

The Operator Terminal connection can be made to either the NCM RS-232 submodule or to the NT Port. Note that the Operator Terminal can be an actual VT100 terminal, or a VT100 emulation program (e.g., ProComm®) running on a PC. The NT cannot be used on an NCM200 running the Operator Terminal software.

**Figure 13: Operator Terminal Connected to the NCM RS-232 Submodule or Connected to the NT Port**
The Hayes-compatible modem connection is only made to the NCM RS-232 submodule. (Note: Modem connections to remote printers are shown under the printer’s cabling sections.)

### Terminal Adapter Cabling (ISDN)
For ISDN dial-up applications, a terminal adapter is used instead of a modem. Metasys supports the Hayes System Adapter. The System Adapter connection is made to Port 2 of the NCM. The System Adapter requires configuration, which is described under ISDN Adapter Configuration in the Operator Workstation Technical Bulletin (LIT-636013).

Figure 15 shows the cable for connecting the NCM (Port 2) to the Hayes System Adapter.
An IBM Proprinter III connects to an NCM’s RS-232 submodule or port, or to a remote Hayes-compatible modem. Figure 16 shows the connections to the RS-232 submodule; Figure 17 to the RS-232 port; and Figure 18 to the modem.

Cable connections for the Lexmark Model 2380 (using Proprinter emulation) are the same as shown for the IBM Proprinter III.

Figure 19 illustrates the Mannesmann Tally PRN-3 connections to the NCM for smoke control applications.

**Figure 16: IBM Proprinter III Connected to the NCM RS-232 Submodule**

**Figure 17: IBM Proprinter III Connected to the NCM RS-232 Port**
For Proprinter III dial-up applications, refer to Figure 14, which shows the pin connections from the NCM to the local modem. Figure 18 illustrates the connections between the remote modem and IBM Proprinter III.

![Figure 14: IBM Proprinter III Connected to a Remote Hayes-Compatible Modem](image)

![Figure 19: Smoke Control PRN-3 Connected to the NCM RS-232 Submodule or RS-232 Port](image)
Cable connections from an RS-232 submodule of an NCM200 using the Gateway program set require the standard NU-CBL101-0 cable with a male hood kit (MHK101) on the JC/85 side (Figure 20).

There are two connection configurations, one for 101, 110, or 112 models of the JC/85 (top illustration), and one for 111 or 113 models (bottom illustration).

Figure 20: Gateway RS-232 Submodule to JC/85 Headend RS-232 Port
The JC/85 trunk cable attaches to the Table Top Modem via the connector (included with TTM), shown with its pinouts (Figure 21).

Figure 21: Table Top Modem to JC/85 Trunk

Cable connections from the TTM101, TTM102, TTM103, and MDM101 (UDS-202) to the S2 NCM RS-232 submodule require the standard NU-CBL101-0 cable with a male hood kit (MHK101) on the TTM/MDM side.

Figure 22: Table Top Modems to the S2 NCM RS-232 Submodule
Software Set Up

Several components integrate software and hardware into a system.

- The *Software Architecture Technical Bulletin (LIT-636010)*, at the beginning of this manual, provides a guide to objects and attributes.

- *NCSETUP for Windows (LIT-6360251d)*, described under the *Commissioning Procedures* section of this document, establishes the NCM’s configuration and parameters in the non-volatile RAM. This information sets the archive data path, the port designations and values, the program set downloaded to the NCM, dial-up phone numbers when applicable, etc.

- The Definition menu [Figure 23] identifies the NCM to the system. The process also correlates NCSETUP parameters, and maps associated graphics and help screens to the defined NCM.

- The *Operator Workstation User’s Manual (FAN 634)* describes the procedural tasks to define hardware objects.

Definition Menu

Identify the NCM to the system by entering data into the attribute fields on the Definition menu. Figure 23 shows the menu as seen on the OWS; a description of each attribute follows.

If the Definition window is brought up from an existing object, then all of the fields are filled in with the data from that object.

Fields that allow data to be modified have the field value boxed. When a field entry is modified, the new value is verified when the field is exited.

For information on how to define the NCM with Graphic Programming Language (GPL) or JC-BASIC, refer to the *GPL Programmer’s Manual (FAN 631)* and *JC-BASIC Programmer’s Manuals (FAN 632)*.

![Figure 23: NCM Definition Window](image-url)
**Object Name**
Enter any valid 1-8 character string. The object name must not presently exist under the system name.

**Expanded ID**
Enter any valid 0-24 character string.

**NC Language**
Enter the first three letters of the language from which to draw the text file that appears on screen: ENGlish, DEUtsch, FRAncais, ESPanol, ITAlian.

**Graphic Symbol Number**
If a graphic has been composed to associate with this object, enter the number of the graphic (1-32767). Zero means no graphic is associated with this object.

**Operating Instructions Number**
When Help is selected for this object, a notepad appears containing user-modifiable operator instructions. Enter the number (1-32767) to reference the desired notepad. Zero means no operator instructions are associated with this object.

**NC Subnet Address**
This is the subnet containing the NCM being set up. Metasys Release 4.0 allows valid options of 1-254. However, enter a 1, except when using a Metasys Ethernet Router. If using a Metasys Ethernet Router, use subnet address 1 for the primary ARCNET segment, or the segment that has the most devices attached to it. See Design Summary in the Metasys Ethernet Router Technical Bulletin (LIT-6295035) in the Metasys Connectivity Technical Manual (FAN 629.5).

**N1 Node Address**
The entry in this field determines the NCM’s node address on the N1 LAN (1-254). The number must be unique on this N1 line.
Port 1 Type

For the NCM200, Port 1 is not a submodule; it is the port to the integrated N2 circuit. Accept the default value of N2.

⚠️ CAUTION: The NCM200 Definition window allows other options. However, Port 1 refers to the integrated N2 connection. You must enter N2 or the port will not function. No internal check is made to ensure that N2 was selected.

Port 2 Type

(L2, S2, JC85, or blank) For the NCM200, Port 2 indicates the communications submodule slot.

- Enter L2 to connect C210 and C260 controllers to the NCM over their local bus.
- If you enter S2 as the Port 2 type, a Baud Rate field appears, whose valid range is 4800 or 9600.
- If you enter JC85 as the Port 2 type, a Baud Rate field appears, whose range is 1200 to 19,200 in the standard baud increments. The best performance is achieved at 9600 baud.

For devices that connect to the RS-232 submodule or integral modem submodule, designate this port type as Blank. For the Operator Terminal program set, designate this port type as Blank.

To define the device that connects into the RS-232 submodule, it is necessary to call that particular device’s Definition window (e.g., a directly connected OWS’s Definition window).

Devices that plug into the RS-232 port are also defined at their own Definition window, instead of on the NCM Definition window.

NT Baud Rate

(300, 600, 900, 1200, 2400, 4800, 9600) Default is 9600.

The Network Terminal transmits at the default 9600 baud rate.

NT Port options are provided to accommodate NT Emulator connections. The Emulator connects to the NT port via the NT jack, and can transmit at different baud rates, depending on the incoming external modem.

This also sets the Operator Terminal baud rate if an OT is connected to Port 2 or Port 4.

For more information, refer to Using the NT Emulator in the Network Terminal User’s Manual (FAN 633).
Commissioning Procedures

Overview

Commissioning a Network Control Module begins after these conditions have been met:
- NCM and associated Power Supply Module are installed into the NCU/NEU.
- Field wiring has been inspected.
- Objects are defined in software for all the modules.

Refer to the Engineering section of this document and the Network Control Unit/Network Expansion Unit Technical Bulletin (LIT-636020) for information on accomplishing the above steps.

The general commissioning tasks are:
1. Install the submodules, set switches, and make the cable connections as necessary.
2. Configure the non-volatile RAM (NOVRAM) file with NCSETUP. See the NCSETUP for Windows Technical Bulletin (LIT-6360251d) for instructions.
3. Confirm proper operation via self-diagnostic tests (indicated by LED lights) and correct responses from the field devices.

No special tools are necessary for commissioning an NCM. If the NCM is new from the factory, a DOS-based computer will be needed to configure the non-volatile RAM. A digital voltmeter is necessary to test the battery submodule.

Setting the N2 End-of-Line Switch

For the NCM200, the N2 End-of-Line (EOL) switch is located on the NCM face plate, above the Network Terminal port. (See Figure 24.)

Setting the N2 EOL to In determines that the NCM is one of the two EOL devices on the N2 Bus. Out means that other modules are daisy-chained (in the backplane) both upline and downline of the NCM. Set at In only if there are no other modules with the EOL set to In in the base frame, and the base frame is at the end of the N2 trunk.
Follow these steps to insert each of the submodules:

1. Ensure that the NCM’s Power Supply Module is turned Off.

2. Open the NCM door.

3. Plug in the submodule, selecting the type and location according to the engineering drawings. The modules are keyed so they can be installed only in the correct orientation.
   - Communications submodules install in the top submodule slot.
   - Network identity modules install in the middle submodule slot.
   - The battery submodule installs in the bottom submodule slot.

   Note: Be careful to position the battery cable so that the module will slide in without binding on the cable.

4. Close the NCM door and restore power to the NCM.

Figure 24: Installing a Submodule
Removing a Submodule

To remove a submodule:

1. Power down the NCM by turning Off its associated Power Supply Module.
2. Grasp the blue bail (the U-shaped bracket on the front), tilt it down to form a handle, and pull the submodule straight out.

Setting the L2/N2 Submodule Switches

The L2 and N2 submodules are the only submodules with switches to set. The power must be Off before setting the switches, or cycled after the switches are set.

**L2 Channel Select Switch:** Indicates which terminal blocks the L2 connects to on the communications terminal board. For information regarding L2 terminations, see the C210-A Controller or C260-A Controller Technical Bulletins in the *Application Specific Controllers Technical Manual* (FAN 636.3). Set the switch to Channel B, corresponding to the TB2 terminals. See Figure 25.

**N2 Channel Select Switch:** Indicates which terminal blocks the N2 connects to on the communications terminal board. Set the switch to Channel B, corresponding to the TB2 terminals. For more information regarding N2 terminations, see the *Dual N2 Bus Application Note (LIT-6363145)* in this manual.

**N2 EOL Switch:** The EOL switch is below the channel select switch on the front of the N2 submodule. Setting the N2 EOL to In determines that the NCM is one of the two EOL devices on the N2 Bus. Out means that other modules are daisy-chained (in the backplane) both upline and downline of the NCM. Set at In only if there are no other modules with the EOL set to In in the base frame and the base frame is at the end of the N2 trunk.

![Channel Select Switch Diagram](image)

**Figure 25: Setting the L2 Submodule Switch**
This section details how to make cable connections to the RS-232 submodule, RS-232 port, integral modem, and NT port.

**RS-232 Submodule and Port**

There are no switches to set on the RS-232C submodule. However, the recessed connector requires a special right-angle cable (NU-CBL101-0) with a narrow-profile shell to connect devices to the submodule or the RS-232 port.

![Figure 26: Right-Angle Cable Connecting to RS-232C Port](image)

The user end of the right-angle cable arrives unbundled to the field. A separately ordered hood, either male (MHK101) or female (FHK101), must be attached according to the receiving connector of the user’s device. If the hood has not been attached, refer to *NCM Cable Guidelines* in this bulletin for wiring and device details.
**Integral Modem**

There are no switches to set on the integral modem; the baud rate automatically configures to the system (300 bps/1200 bps).

Two phone jacks are on the front of the modem submodule. Each jack is marked specifically to connect to the Line and to the Handset cables.

![Internal Modem Jack Connections](image)

**Figure 27: Internal Modem Jack Connections**

**Network Terminal Port**

There are no switches on the NT port. Use the specific RJ-12 cable connection that comes with the NT to plug into the port.

⚠️ **CAUTION:** Do not plug a phone line into the NT port. Plugging a phone line into the RJ-12 port may damage the port and render it unusable.

---

**NCSETUP**

Note: NCSETUP is fully described in the *NCSETUP for Windows Technical Bulletin (LIT-6360251d)*, which you need for commissioning the NCM. The following section contains only hardware and software requirements.

NCSETUP is a software utility that sets up and modifies the non-volatile RAM (NOVRAM) configuration. NCSETUP provides several status and diagnostic functions in addition to storing the system paths by which a restarted NCM can call data and applications from archive files.

NCSETUP is also the utility that establishes to the system what type of NCM is being commissioned (i.e., what program set--standard, security, S2 Migration, etc.).
NCSETUP for Windows is a utility which requires the following hardware to run:

- configured Metasys Operator Workstation - see the Operator Workstation Configurations Technical Bulletin (LIT-636013d) in the Operator Devices section of this manual for information on the PC configuration.

- cabling--If the utility is run via the:
  - RS-232 port on the NCM, a straight through cable is required to connect the COM1 or COM2 port of the PC or portable to the RS-232 port on the NCM. The cable could be 9-pin female or 25-pin female on the PC end, based on the type of PC or portable used. The NCM connection is 25-pin. The serial port on the PC or portable must be connected to the integrated RS-232 port (Port 3) on the NCM.
  - N1, then the N1 coax cable is required to connect the PC or portable to the NCM.

To run the NCM200 requires the following software:

- Release 4.0, or later, of Metasys software (beginning with Release 4.0, the release number appears in the information line directly after you enter “NCSETUP” at the computer)

- A version of NCSETUP matching the Metasys release number. NCSETUP is part of the OWS software.

- DOS 5.0 or later

CAUTION: The NCSETUP software version used to configure an NCM must correspond to the version of Metasys software loaded in the NCM. For example, NCSETUP 5.0 should not be used to configure a system using Metasys software Version 4.0.
Troubleshooting Procedures

NCM Power Up

LEDs

The LED indicators supply evidence of the module’s condition and help determine that the module is functioning properly. See Figure 28.

There are three sets of transmit (XMIT) and receive (RECV) LEDs, corresponding to the on-board N1 LAN circuit, the on-board N2 Bus circuit, and the submodule port. A diagnostic LED window indicates microprocessor status and error codes. The single power LED refers to the circuitry inside the NCM.

N1 Transmit and Receive LED On indicates that data is on the N1 LAN. Transmit LED On indicates that NCM is responding on N1 LAN.

N2 Bus Transmit and Receive LED On indicates that data is on the N2 Bus. A lit Transmit LED indicates that the NCM is responding on the N2.

Communications Submodule Slot Transmit and Receive LED On indicates that data is on the NCM.

Diagnostic LEDs indicate microprocessor status and error codes. Displays NCM address when in normal operation. Lighted Power LED indicates that the module is energized.

Figure 28: LED Indicators on the NCM
1. Upon power up, the power LED lights and the NCM cycles through a self test. The sequence on the diagnostics display should read: 00, 11, 22, 33, 44, 55, 66, 77, 88, 99, and then 00 flashes between ten and twelve times before 88 displays.

2. The self test runs for approximately 30 seconds.

   Note: Transmit/Receive LEDs for the N1 LAN and the submodules are not self-tested. These LEDs function only in response to actual communication.

   • When the self test runs without errors, a steady 88 displays on the diagnostics display for 5 seconds at the end of the test.

   • Check the node address on the display following the self-diagnostics. If the NCM has not been assigned a node address, use NCSETUP to assign an available node number (it comes from the factory as Node 99). If the node number assigned duplicates that of another device’s node number (on either the N1 or N2), a communication error occurs, resulting in erratic (or no) communications transmitted. Reassign a unique node number via NCSETUP for Windows.

   If a conditional error occurs, determine whether or not to replace the module. An error is indicated by the node address flashing on the diagnostics display.

   • If a catastrophic memory error occurs, the test halts at the point of error and displays the particular memory error that occurred (i.e., 01, 02, 03). Reset the NCM by cycling power or pressing the Reset button. If the error repeats, replace the module.

   • If a non-catastrophic error occurs, the microprocessor completes the self test, then displays the corresponding error number for 5 seconds. (If multiple errors occur, only the first error detected displays.) After the 5-second error display, the NCM node address displays (flashing, to indicate an error), and the NCM begins normal operation.

   • If the NCM continuously resets itself, a severe hardware failure has occurred. Replace the module.

   Table 3 describes and gives a remedy for errors that register on the diagnostics display. Use the table to determine whether it is necessary to replace the NCM (for example, the 05--Communications Submodule error--is not significant if the NCM does not utilize a communications submodule).

   Errors 08 and 11 are conditional errors; the NCM functions normally, but the errors may reduce reliability. If these errors are indicated, monitor the LEDs and equipment response to verify continued correct operation.
### Table 3: Diagnostic Display, Descriptions, and Remedies

<table>
<thead>
<tr>
<th>Diagnostic Display</th>
<th>Error</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Memory Error (Catastrophic)</td>
<td>Reseat the NIM and cycle power. If the 01 error still occurs, either the NIM or the NCM is malfunctioning. If a known, good NIM fails in the slot, replace the NCM.</td>
</tr>
<tr>
<td>02 - 03</td>
<td>Memory Error (Catastrophic)</td>
<td>Cycle power and perform a cold restart by pressing the Reset button. If the NCM does not recover (reset without catastrophic error), replace the module.</td>
</tr>
<tr>
<td>04</td>
<td>N2 Port Internal Error</td>
<td>Cycle power. If the 04 error still occurs, N2 communications are malfunctioning. Replace the NCM.</td>
</tr>
<tr>
<td>05</td>
<td>Communications Submodule Internal Error</td>
<td>Cycle power. Typically used for modem, RS-232, or L2. If the 05 error still occurs, communications through this submodule slot are malfunctioning. Replace the NCM.</td>
</tr>
<tr>
<td>06</td>
<td>RS-232 Port Internal Error</td>
<td>RS-232 port will not operate; replace NCM to use.</td>
</tr>
<tr>
<td>07</td>
<td>NT Port Internal Error</td>
<td>NT port will not operate; replace NCM to use.</td>
</tr>
<tr>
<td>08</td>
<td>Sanity Timer Failure</td>
<td>The NCM can operate normally, but possibly at a reduced level of system reliability. (Time-of-day may also be affected if Sanity Timer fails.)</td>
</tr>
<tr>
<td>11</td>
<td>Clock/Calendar Chip Error</td>
<td>Error 11 indicates a timing variance error. Slight timing errors may be corrected manually. Severe errors (or no timing functions at all) indicate a hardware problem sufficient to replace the NCM.</td>
</tr>
<tr>
<td>12</td>
<td>ARCNET Internal Error</td>
<td>Cycle power. If the 12 error still occurs, communications via the N1 LAN are malfunctioning. To use N1, replace the NCM.</td>
</tr>
</tbody>
</table>

### Power Related Field Checks

After self-diagnostics are completed, follow the power-related field checks provided below if operational problems develop. The sections are listed in the typical order that a user encounters problems.

#### Power Indicators and Troubleshooting

The power LED on the NCM should turn on at power up and remain on throughout NCM operation.

1. If the power LED turns off (and the power supply module is functioning properly), power is being lost either in the connections between the power supply module and NCM, or inside the NCM.
   - Inspect the connectors to ensure that the connector pins or wires have not been bent, broken, or pulled out.
• If possible, test the connections by installing a known functioning NCM module into the slot. During this procedure, disconnect the NCU from the N1 LAN (or ensure, via NCSETUP, that the node address of the functioning NCM will not conflict with any other address on the network).
  - A functioning NCM verifies the connection. Replace the suspect NCM.
  - If a functioning NCM fails in the slot, the problem may reside in the Power Supply Module or NCU/NEU base frame. Refer to the Network Control Unit/Network Expansion Unit Technical Bulletin (LIT-636020), Troubleshooting Procedures section for those units.

2. If the NCM powers up with 88 displayed, and remains in that state with the power LED Off, the NCM is not receiving a power-on reset signal from the power supply.
  • Ensure that the +5 VDC LED is lit on the power supply module.
  • Follow the procedure in the Step 1 to determine if the fault lies in the NCM, base frame connection, or power supply module.

3. If the NCM displays an 08 error, 50/60 Hz line frequency is not present. Follow the procedures outlined in Step 1 to determine if the NCM, base frame, or power supply module is at fault.

**Power (Battery Submodule)**

Evidence of a failed battery is the NCM losing memory when power is cycled. (To replace the battery, or review the replacement timetable, see the Service section of this document.)

There are no internal self-tests for the battery backup submodule. The tests presented below isolate the problem to the battery or the battery charger. A quick preliminary test is offered for both the battery and charger, followed by more extensive tests if the problem is not discovered.

1. **Battery Submodule (preliminary)**
   • Unplug the battery submodule and inspect the connectors to ensure that the connector pins or wires have not been bent, broken, or pulled out. Power can remain On for the NCM when you remove the battery submodule.
   • Measure the open circuit voltage across the first two pins from the left at the connector of the battery submodule [Figure 29]. The value should read between 6.7 and 7.5 VDC. A good battery should never read less than 5.5 VDC. Voltages below this are often due to battery failure or extensive discharge.
2. **Battery Charger (preliminary)**

A defective charger may not provide full battery capacity; in severe cases, it could actually drain the battery. A preliminary test of the charger is as follows:

- While maintaining power to the NCM, remove the battery submodule.
- From within the NCM, extract the cable that connects to the battery submodule.
- Locate Pin 1 on the connector. It is marked by the arrow-shaped triangle on the latching side of the connector. The wire is red on the NCM.
- Measure the open circuit voltage across Pins 1 and 2 (Pin 1 is positive). If the charging circuit is good, the voltage should read between 7 and 8 VDC.

Failing the preliminary charger test indicates a charger failure. Replace the NCM. (Replace the battery submodule if the charger passed this test and the battery failed its open circuit test.)

The charger may, however, pass the preliminary test but still not adequately charge the battery submodule. If the battery and charger pass their preliminary tests, apply the more extensive tests that follow.
3. **Battery Submodule (loaded test)**

Loaded means to attach a resistor on the battery to check if the battery supports a specified load over a specified time.

Since this test checks capacity, it is also useful as a maintenance tool.

Note: This test checks the battery’s capacity. Before running the test, fully charge the battery in the NCM for 24 hours.

- Attach a 5 ohm (4.7 to 5.1), 10 watt (minimum) resistor across the battery submodule’s + and - wires leading to the connector pins (see Figure 29). Allow the battery to discharge for 30 minutes.
- After 30 minutes, remove the resistor and measure the open circuit battery voltage. Take this measurement within 20 seconds of removing the load because the open circuit voltage rises as soon as the load is removed. (By measuring within 20 seconds, this rise is limited to about 0.1 volt.)
  - If the battery reads above 5.5 VDC, it should support the 72 hour backup time.
  - If this test fails, perform the loaded battery charger test (Step 4) to ensure that the NCM is fully charging the battery.

4. **Battery Charger (loaded test)**

The test below ensures that the charger functions under conditions simulating an installed battery submodule:

- With the unit powered up, connect a 100 ohm, 1 watt resistor across Pins 1 and 2 (the same pins designated in the preliminary test).
- Measure the voltage across the resistor. The voltage should read between 6.0 and 8.0 VDC. Voltage readings outside this window (either above or below) indicate that the charger does not fully charge the battery.
Unless the NCM has worked previously, or only one NCM on the N1 is not communicating, this symptom points to an error in the software configuration or cabling.

1. Ensure that the NCM is correctly addressed on the OWS (the NCM address must match what the OWS thinks it is, and the NCM archive address must point to the appropriate archive PC).
   - If the N1 transmit LED blinks frequently while yielding intermittent, or no communication, the blinking indicates that the N1 is constantly reconfiguring. This is a clue that there are duplicate addresses on the LAN, or that there is a problem with the N1 wiring.

2. Ensure that the physical configuration of the system is within guidelines. These include cable lengths and integrity, end-of-line terminators, N1 and N2 connections, the number of devices on each trunk and the proper selection of the ARCNET bus/star configuration. Related Commissioning Problems, at the end of this section, includes notes on cabling and EOL terminations. Also refer to: Network Control Unit/Network Expansion Unit Technical Bulletin (LIT-636020), N1 Local Area Network Technical Bulletin (LIT-636017), and N2 Communications Bus Technical Bulletin (LIT-636018).
   - Configurations marginally outside specification will fail bootups occasionally (for example, one in five may fail). A different NCM may increase or decrease the failure rate of a marginal configuration.
   - If, in the N1 Diagnostics Window, the RECONS value remains steady, and there are no duplicate addresses, the N1 wiring is probably good.

3. Ensure that the version of NCSETUP is compatible with the Metasys Release being used.

4. Inspect the error logs (both in the NCM and the OWS) for the source of the problem.
   - For the NCM, use NCSETUP--(B) Read Logfile Data
     Note: If the NCM continuously reboots--and erases the Error Log--run NCSETUP and answer No to the Reboot on Error prompt. Then call the Error Log. Make sure to reset the prompt to Yes when the problem is resolved.
   - For the OWS, read the ERRORLOG.TXT file--NC Task/Error Log; Troubleshooting Guide Technical Bulletin (LIT-636328)

5. Attempt a direct-connect communication to the NCM.
Use the following procedures if you can communicate with the NCM, but cannot download properly:

1. Test the download procedure with a known, good NCM.
2. Test the download procedure with a known, good OWS.
3. Test the download procedure with a known, good cable (particularly check the N1 connections).
4. Inspect the error logs (see Step 4 in previous section).
5. Recompile the software to see if that resolves the download problems.

If data base definitions have changed, inspect the changes to ensure that points that are referenced haven’t been erased.

The following checks can help to isolate network-related problems:

1. After confirming the proper node address, test the NCM’s ability to communicate over the N1 LAN. Transmit (XMIT) and Receive (RECV) LEDs should respond to activity. (Also see N1 End-of-Line Termination Notes at the end of this Troubleshooting Procedures section.)

2. Next, for a Standard Functionality NCM, verify that the device is being polled on the N2 Bus. This is evident if the XMIT LED lights, which indicates that the NCM is replying to a poll.

   Note: The S2 Migration and JC/85 Gateway networks connect to a Metasys system via the RS-232 submodule. For those networks, see the field checks under Submodule and Port Field Checks for the RS-232 submodule, further in this document.

   • If the RECV and XMIT LEDs respond irregularly, and the Definition window lists all the devices on the N2 trunk for the NCM as being Offline, the polarity of the N2 wire connection may be reversed. Inspect the N2 wiring to ensure that the same color wire exits at the TBC terminal as at the originating end of the N2 trunk. For further information, refer to N2 Communications Bus Technical Bulletin (LIT-636018) under Network Communications, in the Metasys Network Technical Manual.

   • If the XMIT LED never lights, check if the green RECV LED lights.

   • If the RECV LED does not light, the NCM is not connected to the N2 Bus. Follow Steps 3-7 (below) to troubleshoot the N2, or refer to the N2 Communications Bus Technical Bulletin (LIT-636018) under Network Communications, in the Metasys Network Technical Manual.
• If the RECV LED does light without the XMIT LED ever responding, perhaps no messages are being addressed to the NCM. Ensure that the system is configured to poll the NCM by checking the address on NCSETUP.

3. Verify that the N2 wires terminate on the A terminal blocks of the Communications Terminal Board, and that the L2 wires (if used) terminate at the B terminal blocks. If the L2 submodule is installed, ensure that it is set to the B channel.

4. Check the EOL switch. If, by accident, more than two EOL switches are set on a heavily loaded network, normal communication could be disrupted (erratic or non-functional).

5. Attempt to isolate the N2 device nearest the panel. Establishing communication to that device indicates that the N2 interface is operating correctly, and the problem lies in the field wiring.

6. Cycle power to the NCM. Check the self-diagnostics LEDs for indications of a failure: Error code 12 indicates an N1 error, 04 indicates an N2 error.

7. Ensure that the TBC fuses are good for the N2 trunk. See the Network Control Unit/Network Expansion Unit Technical Bulletin (LIT-636020) in this manual.

Submodule and Port Field Checks

Network Identity Module

Use the following steps to isolate problems related to the NIM:

1. If the NCM200's LED diagnostic display reads 01, reseat the NIM and cycle power.

2. A continued reading of 01 indicates malfunctioning of either the NCM or the NIM. Install a known, good NIM into the slot and cycle power.

3. If the 01 failure is still observed, replace the NCM.

Modem Submodule

Use the following steps to isolate problems related to the modem submodule:

1. If the RECV integral modem LED (on the NCM) does not light, ensure that the submodule is completely inserted and a wall line is inserted in the Line jack on the modem submodule.

2. Plug a working phone into the Handset jack; a dial-tone indicates a good connection.

If no dial-tone is heard, isolate the problem to either the wall line or submodule. Disconnect the phone from the Handset jack and plug the wall line directly into the phone. A dial-tone indicates a functioning wall line.
3. If the wall line connection is good and the modem is completely inserted, but communications have not yet been established:
   - Swap a functioning modem submodule into the port. Correct operation isolates the problem to the original modem.
   - Cycle power to the NCM. The self-diagnostics will indicate if the NCM port containing the modem is in error (error code = 05).

4. Test the remote modem to ensure that it is functioning properly:
   - Has the remote modem failed?
   - Are the remote modem’s switches properly set?
   - Is the remote modem-to-OWS cable functional?

5. Ensure that the data base is properly defined.

**RS-232 Port**

Use the following steps to isolate problems related to the RS-232 port submodule:

1. If not communicating via the RS-232 port, check for the proper cable configuration (DCE or DTE). Review the cable diagrams in the NCM Cable Guidelines section of this document.

2. Verify that baud rate is compatible with the device. Use the NCSETUP routine to monitor and change the baud rate, if necessary.

3. Cycle power to the NCM. The self-diagnostics will indicate if the NCM RS-232 port is in error (RS-232 port error code = 06).

**Network Terminal**

Upon power up, the NCM’s diagnostic LEDs indicate internal errors. Error number 07 indicates that the NT Port is not functioning. See the Network Terminal Technical Bulletin (LIT-636012) in the Metasys Network Technical Manual (FAN 636) for more details.

**L2 Submodule**

Use the following steps to isolate problems related to the L2 submodule:

1. If the RECV L2 LED (on the NCM) does not light, or the L2 network is designated as Offline on the OWS, ensure that the L2 submodule is fully inserted.

2. Verify that the L2 wires terminate on the B terminal blocks of the communications terminal board, and the L2 channel switch is set to B.

3. Ensure that the module is addressed correctly, and that polling takes place between the NCM and L2 devices.
4. Attempt to isolate the L2 device nearest the panel. Establishing communication to that device indicates that the L2 interface is operating correctly, and the problem lies in the field wiring.

5. Swap a functioning L2 submodule into the slot. Correct operation isolates the problem to the original L2 submodule.

6. If the functioning L2 submodule fails in the slot, cycle power to the NCM. The self-diagnostics will indicate if the NCM port containing the L2 Submodule is in error (error code = 05).

7. Remove the L2 submodule to see if communications clear at the NCM port. (Check the LEDs; this step helps in cases where the trunk may be shorted. Removing the submodule may indicate that the NCM is good and isolate the problem to the trunk.)

8. Check that the TBC ribbon to the backplane is secure.

9. Make sure that the TBC fuses are good.

**RS-232 Submodule**

The RS-232 submodule functions in the same manner, whether in the Standard or Migration functionality. Check the following:

1. If the RECV RS-232 submodule LED (on the NCM) does not light, ensure that the submodule is completely inserted.

2. If XMIT LED is active, but RECV LED does not respond to incoming data from the field device, check the configuration of the RS-232 cable (DCE or DTE), which may be crossed. Refer to the *NCM Cable Guidelines* section in this document for illustrations and details.

3. Swap a functioning RS-232 submodule into the port. Correct operation isolates the problem to the original submodule.

4. Ensure that the controlled device functions and is configured properly.

5. Ensure that the controlled device is defined in the software.

6. Cycle power to the NCM. The self-diagnostics will indicate if the NCM port containing the RS-232 Submodule is in error (Port 2 error code = 05).

Additional checks for S2 Migration connections:

- Check that the Table Top Modem LEDs are blinking (not steady On or steady Off) before investigating problems with the RS-232 submodule.

- Check that the S2 software was downloaded (NCSETUP menu item C, *Read NC Type*).
For problems that occur with the S2 Migration network, refer to these documents:

- Table Top Modem or S2 hardware: *JC/85/40 Hardware Data Book (FAN 497)*

- S2 Software:
  - Network Toolbox software (optional): Diagnostics Feature, S2 Statistics

For JC/85 Gateway connections, additional checks:

- Since the JC/85 polls the Gateway NCM, the RECV LED should light before the XMIT. If the XMIT LED lights first, ensure that the cable between the JC/85 and RS-232 submodule is not backwards.

- Check that the JC/85 software was downloaded (NCSETUP menu item C, *Read NC Type*).

For problems that occur with the JC/85 Gateway network, refer to:

- JC/85 hardware: *JC/85/40 Hardware Data Book (FAN 497)*

- JC/85 software: *Programming Options, 01-12: JC/85/40 Software Data Book (FAN 534)*

Additional checks for RS-232 Remote Modem applications:

- (For 1200 Baud Hayes) Ensure that the remote modem’s switch settings are correct.

- (For 2400 Baud Hayes, and above) Ensure that the NOVRAM parameters are correctly loaded.

- (For Multi-Tech®) Ensure that the remote modem’s switch settings are correct. (Refer to switch settings in the *Metasys Network Technical Manual, App. Notes: Network Communications, Leased Line Modem Application Note, (LIT-6363141)*

**NCSETUP Field Checks**

One reason that an NCM appears to not function properly is that the NCSETUP software version used to configure it is not appropriate to the version of Metasys software loaded in the NCM. For example, NCSETUP 3.0 should not be used to configure a system using Metasys software Version 4.0, or NCSETUP 4.0 to configure Metasys software Version 3.0.

An NCM200 requires Metasys Release 4.0 (or later) software. Beginning with Release 4.0, NCSETUP is contained within the Metasys PMI software, and the release number appears in the information line directly after you enter NCSETUP at the computer.
Failing to use corresponding NCSETUP and Metasys software versions may result in these symptoms:

- Files do not download from the configuring PC to the NCM.
- Files do not upload from the NCM to the PC.
- The NCM does not talk on the N1 LAN.
- The NCM runs out of acquired memory.
- The NCM continuously reboots, or reboots on its own.

If these symptoms appear, rerun NCSETUP after ensuring that the correct Metasys Release software (including its corresponding NCSETUP version) has been loaded onto the hard drive, and that no other version of NCSETUP is accessed, either from another subdirectory, or from incorrect floppy disks.

---

**Related Commissioning Problems**

**RS-232 Port Cable**

Failed downloads have resulted from incorrect cabling between the configuring PC and the RS-232 port. A straight-through cable connects from the NCM RS-232 port to the OWS (PS/2 Platform) Serial Port. In addition, Deskpro® and Portable Workstations (Compaq platform) also require a 9- to 25-pin cable converter.

Illustrations of the pinouts for these cables are shown in the *NCM Cable Guidelines* section of this document.

**RS-232 Baud Rate**

Failed downloads have also resulted from incompatible baud rates between the configuring PC and the RS-232 Port. The RS-232 port defaults to a baud rate of 9600. After the NCM has been successfully configured, you can change the baud rate within the ranges of 300 to 19.2K. However, if the NCM RS-232 port has been changed from the default of 9600, and you must perform NCSETUP again, you will have to attempt different baud rates until you find the rate that is currently loaded into the NCM memory (NOVRAM). Otherwise, NCSETUP will fail.

**N1 Statistics Diagnostics**

System representatives have assumed their NCM was faulty due to the appearance of error counts during the N1 Statistics Diagnostics. (See the *Operator Workstation User’s Manual, Advanced User’s Guide.*) Some error counts are typically generated when running the diagnostics. Determining when the normal range of errors has been exceeded is somewhat difficult because of site and configuration variables.
If, when running the diagnostics, you believe there are an excessive number of errors, regard the errors as a warning to test the functionality of the NCM. You can assume that a properly functioning NCM is good, and that there is no need to return it. A rule of thumb is that NCMs typically keep diagnostic errors around 0.1% or less.

Remember, in situations where diagnostic errors are greater than 0.1%, there can be causes other than the NCM. If the errors increase as fast as the number of transmits and receives process, something is likely wrong.

1. Use 93 ohm terminators and RG-62 type cable for the N1 LAN. JC/80 cabling systems commonly used 50 ohm terminators on 50 ohm cabling. These systems should be isolated from the N1 LAN by an active link.

2. The OWS may contain an internal EOL termination resistor.
   - To prevent adding a third resistor to the network, determine whether or not your OWS has an internal EOL resistor. (Refer to your computer manual.)
   - If the OWS has a resistor, make sure that it is positioned at the end of the line. Ensure this either by positioning the OWS at the end of the line, or by jumpering the board to disengage the EOL resistor, and adding a resistor at the proper position.
   Notes: On the approved active hubs, the cables are terminated internally.
   On the approved active links, external terminators are required for each EOL connection.

3. There are two methods to check the termination LAN resistance:
   - Power down the network, and with the LAN cables connected, insert a T-connector and measure the conductor-to-shield resistance. The value should nominally be 46.5 ohms, with an acceptable range of 46 to 54 ohms. If properly terminated, it doesn’t matter how many NCMs are online. Readings less than 46.5 indicate that more than two terminations are on the LAN. A reading of 93 indicates that only one termination is on the LAN. (N1 LAN confidence-level tests may be found in the, JC/80 Coax on N1 LAN Technical Bulletin (LIT-6363142) in the App. Notes: Network Communications section of the Metasys Network Technical Manual (FAN 636).
   - If available, use a time-domain reflectometer to estimate where a problem or discontinuity exists.
4. As a general N1 termination check, the outside conductor must be isolated from the earth ground for proper operation. Test N1 connections (including barrel connectors) for possible shorts from the outside conductor shield to ground. The resistance should be in the Meg ohm range.

The battery submodule may be serviced in the field by replacing it. The battery submodule can last up to ten years, depending on the ambient room temperature. Below is a guideline indexed by temperature for battery replacement.

<table>
<thead>
<tr>
<th>Ambient Operating Temperature</th>
<th>Typical Battery Life</th>
</tr>
</thead>
<tbody>
<tr>
<td>(°F)</td>
<td>(°C)</td>
</tr>
<tr>
<td>32°</td>
<td>0°</td>
</tr>
<tr>
<td>41°</td>
<td>5°</td>
</tr>
<tr>
<td>50°</td>
<td>10°</td>
</tr>
<tr>
<td>59°</td>
<td>15°</td>
</tr>
<tr>
<td>68°</td>
<td>20°</td>
</tr>
<tr>
<td>77°</td>
<td>25°</td>
</tr>
<tr>
<td>86°</td>
<td>30°</td>
</tr>
<tr>
<td>95°</td>
<td>35°</td>
</tr>
<tr>
<td>104°</td>
<td>40°</td>
</tr>
<tr>
<td>113°</td>
<td>45°</td>
</tr>
<tr>
<td>122°</td>
<td>50°</td>
</tr>
</tbody>
</table>

1. Remove the battery by grasping its bail and unplugging it from the submodule. See Figure 24. The battery submodule (alone among the submodules) can be replaced while the NCM is installed and power is On.

2. Test the battery submodule as described in the Battery Submodule section of this document under Engineering, Components.

3. Install the battery submodule in the same manner as the other submodules (being careful to not damage the cable connecting the battery).
Specifications and Order Codes

The following specifications may be used as a general guide to the operating parameters and components of the NCM200.

### Table 5: Specifications

<table>
<thead>
<tr>
<th>Specification</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply Voltage</td>
<td>85 to 264 VAC, 50-60 Hz</td>
</tr>
<tr>
<td>Power Consumption</td>
<td>Power is from the power module (NU-PWR101-0)</td>
</tr>
<tr>
<td>Ambient Operating Conditions</td>
<td>32 to 122°F/0 to 50°C/10 to 90% RH non-condensing</td>
</tr>
<tr>
<td>Ambient Storage Conditions</td>
<td>-40° to 158°F/-40° to 70°C/5 to 95% RH</td>
</tr>
<tr>
<td>Internal Batteries</td>
<td>Shelf life (disconnected): 10 years&lt;br&gt;Typical working life, with power: See Table 4: Typical Battery Replacement Timetable&lt;br&gt;Maintains RAM programs/data for up to a 72-hour power failure&lt;br&gt;Automatically recharges from NCM</td>
</tr>
<tr>
<td>Serial Interfaces</td>
<td>One internal RS-485 interface for N2 connection; 19.2K baud&lt;br&gt;Three RS-232-C ports (300 through 19200 baud):</td>
</tr>
<tr>
<td>Processor</td>
<td>80386 @ 16 MHz</td>
</tr>
<tr>
<td>Memory</td>
<td>4 MB standard</td>
</tr>
<tr>
<td>EEPROM Size</td>
<td>256 Kb</td>
</tr>
<tr>
<td>Data Base Capacity</td>
<td>(NIM206) 1,200 Kb</td>
</tr>
<tr>
<td>Dimensions (L x W x H)</td>
<td>14 x 2.25 x 7.0 in./35.5 x 5.7 x 17.8 cm</td>
</tr>
<tr>
<td>Shipping Weight</td>
<td>5 lb/2.25 kg</td>
</tr>
<tr>
<td>Agency Compliance</td>
<td>FCC Part 15, Class A</td>
</tr>
<tr>
<td>Agency Listings</td>
<td>UL 916 Listed&lt;br&gt;CSA C22.2 Number 205&lt;br&gt;UL 864 Listed</td>
</tr>
</tbody>
</table>
Use the following product code numbers when ordering parts for the NCM200.

### Table 6: Product Code Numbers

<table>
<thead>
<tr>
<th>Description</th>
<th>Product Code Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Network Control Module 201 (NCM200 which includes the NIM206-1)</td>
<td>NU-NCM201-1</td>
</tr>
<tr>
<td>Network Control Module 201 (Repair NCM200 which includes the NIM206-1))</td>
<td>NU-NCM201-701</td>
</tr>
<tr>
<td>Replacement Network Identity Module 206</td>
<td>NU-NIM206-1</td>
</tr>
<tr>
<td>Table Top Modem (Johnson Controls Proprietary Line)</td>
<td>TTM101-0</td>
</tr>
<tr>
<td>Table Top Modem (Leased Line)</td>
<td>TTM102-0</td>
</tr>
<tr>
<td>Table Top Modem (JC/LINK Generic Bridge)</td>
<td>TTM103-0</td>
</tr>
<tr>
<td>Table Top Modem (Alternative Leased Line)</td>
<td>MDM-101-0</td>
</tr>
<tr>
<td>(Outside Vendor No. UDS-202)</td>
<td></td>
</tr>
<tr>
<td>Power Supply Module</td>
<td>NU-PWR101-0</td>
</tr>
<tr>
<td>L2 Submodule</td>
<td>NU-L2B101-0</td>
</tr>
<tr>
<td>Modem Submodule</td>
<td>NU-MDM101-0</td>
</tr>
<tr>
<td>RS-232 Submodule</td>
<td>NU-COM101-0</td>
</tr>
<tr>
<td>RS-232 Cable 35’ (Right angle with narrow profile)</td>
<td>NU-CBL101-0</td>
</tr>
<tr>
<td>Male Hood Kit for NU-CBL101-0</td>
<td>MHK101</td>
</tr>
<tr>
<td>Female Hood Kit for NU-CBL101-0</td>
<td>FHK101</td>
</tr>
<tr>
<td>Battery Submodule</td>
<td>NU-BAT101-0</td>
</tr>
<tr>
<td>Lexmark Model 2380</td>
<td>WS-PR2380-001</td>
</tr>
</tbody>
</table>

Note: If you return the NCM for repair, include the battery submodule (NU-BAT101-0) and the NIM206 with the return shipment.

Do not return any other submodules with an NCM.

For further information on returning a defective NCM, refer to Material Return and Allowance Program, Procedure 3C2700.