Communication Adapters

N-485-API-2
N-485-PCI-2
N-485-HUB-2

Installation Guide

TD1077 rev0601

Contents

System Overview

High speed data transmission between computer system components and peripherals over long distances, under noisy conditions, is usually very difficult with single-ended drivers and receivers. RS-485 is a balanced (differential) digital transmission interface developed to incorporate and improve upon the advantages of current-loop interfaces and improve upon RS-232 limitations. RS-485 allows increased line length [up to 4000ft (1219m)] and is less sensitive to electrical noise.

The personal computer interface (N-485-PCI-2) or the remote dial-up modem adapter (N-485-HUB-2) are connected by the RS-485 Multi-Drop network to various Access Panel Interface (API) boards (N-485-API-2 and N-1000III/IV configured for RS-485). Each API is connected to an N-1000-II Panel via its 20mA input and output connections.

This manual describes functions and procedures in reference to version 2 of Northern Computer's 485 adapters. The N-485-2 series cannot be used with the earlier N-485 components.

Note: *It is recommended that all N-485-2 components (APIs, PCIs, HUBs) have the same version firmware. For further information contact Northern Computers, Inc.*

Communication between the various APIs and the PCI or HUB is supervised with checksums and CRCs (and corrupt packets are retransmitted) at all times. Communication between the Host Computer and the PCI or the HUB is supervised with checksums (and corrupt packets are retransmitted) if "ACK-NAK" is turned on at both the PC and the PCI. The connection from each API to its N-1000-II is supervised by testing (with the space-return method) every 10 seconds.

The baud rate between the PCI and the APIs is 38,400 and the transmissions from the APIs are compressed (except for reports). The baud rate from the PCI to the PC can be selectable up to 19.2K. The baud rate from the HUB via the dial-up modems to the PC, can be up to 19.2K. The baud rate from the API to the N-1000 can be any one of the standard N-1000 (version 8) baud rates, up to 4800 baud.

The wire used for the entire length of each multi-drop line must be the same cable with the same characteristic impedance (see cable specifications). The old NCI repeaters can not to be used with the new 485 version 2 system. Use the new repeater, part number N485DRLA.

N-485-PCI-2 (Personal Computer Interface)

The PCI unit functions as the interface between the personal computer (9 pin, RS-232) and the RS-485 bus. The unit, which has its own enclosure, translates the PCs CIDD protocol to the proprietary RS-485 protocol.

The PCI acts as the arbitrator of the line, polling each API for its information, and determining its status. If an API or panel drops out, the PCI notifies the host. If communication to the host is lost the PCI buffers the APIs and panels. (Must be using WIN-PAK ver 1.10.25 or higher using 485 ACK/NAK option.) Communications with host can only be determined when the PCI is running in the ACK/NAK mode of operation.

U.L. Application Note: The N-485-PCI-2 power specifications: 120vac 60hz 6 watts. The N-485-PCI-2 has been U.L. rated. (The N-485-PCI (earlier series) and N-485-HUB-2 have not been tested by U.L.).

N-485-API-2 (Access Panel Interface)

The API functions as the interface between the control panel and the RS-485 multi-drop bus. The unit is mounted in the control panel enclosure and connects directly to the 20 mA port on the panel. Each panel receives only commands addressed to it on the bus via the API. The APIs need to have the same address as their corresponding panels. The API dip switches control the baud rate and address, and need to be set exactly the same as the panel. The API expects to be polled by the PCI. All transactions are sent to the PCI unit and verified. If there is an improper response from the PCI (or no response due to loss of power), the API buffers these transactions until communication is re-established. If the API approaches buffer capacity (64 transactions), it sets the control panel to the buffered mode. When communication is re-established, all buffered transactions are then sent to the PC via the API.

Note: API dip switch settings need to match the N-1000-II panel settings (Version 8.0 or newer panel firmware). API/Open=N-1000/Off.

Note: If the control panel has been told to buffer from the PC-software, the API will not remove the panel from buffered mode. The panel will remain in the buffered mode until the computer tells it to unbuffer.

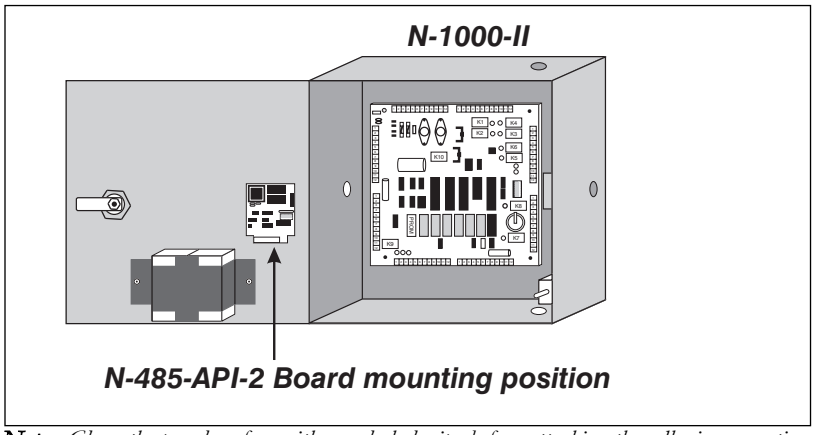
Note: Each dropline can have a maximum of 31 panels.

N-485-HUB-2 (Modem Interface)

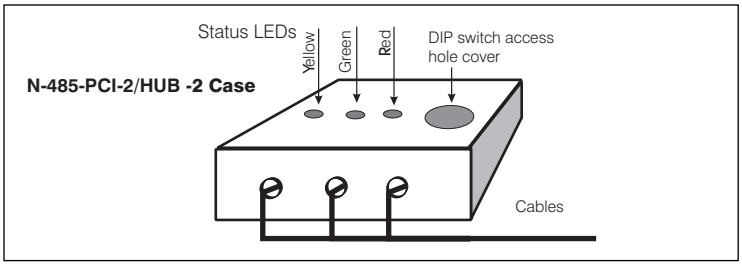
In the remote dial-up system the local modem at the PC is used to dial the remote modem at the HUB. This is done to send information to the N-1000 panels or to retrieve information from the N-1000 panels. The information can be two fold, transactions or responses. The HUB is set up to perform answer and dial out functions in conjunction with its modem. The HUB will dial the local modem upon an alarm from the N-1000 panel. In all other respects the HUB acts in the same manner as described for the functions of the PCI. Configurations using the N-485-HUB-2 require WIN-PAK 1.10.25 or higher and M9600-2 modems.

Mounting

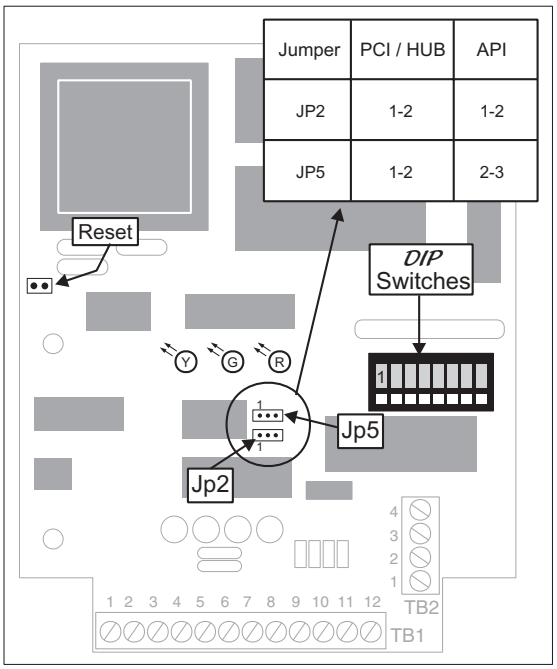
Mounting position for the API is shown below:



Note: Clean the panel surface with an alcohol wipe before attaching the adhesive mounting stand-offs supplied on the printed circuit board.



DIP Switches & Jumpers



The switches are read at power-up or reset. They must match the settings required by the PC software. If the switch positions are changed while the device is running, the device must be reset or power cycled to have the new switch settings take effect.

N-485-PCI-2/HUB-2 Switches

N-485-PCI-2/N-485-HUB-2

Baud Rate	Switch 7	Switch 8
1200	O	c
2400	O	O
9600	c	c
19.2 K	c	O

Switches 1, 2, 3, 4 and 5 are always closed. Switches 6, 7, and 8 can be changed, refer to the following:

Switch 6 set to the open position indicates that the PCI/HUB is talking ACK/NAK to the PC. Switch 6 set to the closed position indicates the non ACK/NAK mode of operation. Switches 7 and 8 determine the baud rate of the RS-232 port.

API DIP Switches

NOTE: API switches must match control panel address.

API #	S8	S7	S6	S5	S4	S3
1	o	c	c	c	c	c
2	c	o	c	c	c	c
3	o	o	c	c	c	c
4	c	c	o	c	c	c
5	o	c	o	c	c	c
6	c	o	o	c	c	c
7	o	o	o	c	c	c
8	c	c	c	o	c	c
9	o	c	c	o	c	c
1o	c	o	c	o	c	c
11	o	o	c	o	c	c
12	c	c	o	o	c	c
13	o	c	o	o	c	c
14	c	o	o	o	c	c
15	o	o	o	o	c	c
16	c	c	c	c	o	c
17	o	c	c	c	o	c
18	c	o	c	c	o	c
19	o	o	c	c	o	c
2o	c	c	o	c	o	c
21	o	c	o	c	o	c
22	c	o	o	c	o	c
23	o	o	o	o	o	c
24	c	c	c	o	o	c
25	o	c	c	o	o	c
26	c	o	c	o	o	c
27	o	o	c	o	o	c
28	c	c	o	o	o	c
29	o	c	o	o	o	c
30	c	o	o	o	o	c
31	o	o	o	o	o	c

Baud Rate	S1	S2
4800 Recommended	c	c
1200	0	0
2400	0	c

Terminal Blocks

485 board terminal blocks are shown below:

TB1 Terminal	N-485-API-2 Function	Color Code
1	20 mA receive (+) connects to N-1000 TB7 #11	White
2	20 mA receive (+) connects to N-1000 TB7 #12	Green
3	RS-485 (B–) End of Line Jumper connects to TB2 #2*	Black
4	20 mA transmit (+) connects to N-1000 TB7 #9	Red
5	RS-485 (A+) End of Line Jumper connects to TB2 #1*	Red or White
6	20 mA receive (–) connects to N-1000 TB7 #10	Black
7	Port 1: RS-232 transmit (not used at this time)	
8	Port 1: RS-232 receive (not used at this time)	
9	Port 0: RS-232 transmit/DB9-pin 2 (PC)/ DB25-pin 2(modem)	
10	Port 0: RS-232 transmit/DB9-pin 3 (PC)/ DB25-pin 3 (modem)	
11	Ground BD9-pin 5/DB25-pin 7	
12	Ground 485 Cable shield if used (see wiring notes)	

TB2 Terminal	Function
1	End of line jumper connects to TB1 #5*
2	End of line jumper connects to TB1 #3*
3	9-12 Volts DC or AC (not polarity sensitive)
4	9-12 Volts DC or AC (not polarity sensitive)

Note: ** Applies only to boards at the end of the multi-drop line.*

Note: *Check that the board's power source is at least 8.0 volts DC or AC. If the voltage on any one board drops too low, it will prevent all other boards from communicating. This can happen during battery back-up operation.*

Cable Specifications

485 Board cable specifications are shown below:

From:	To:	Wires	Length	Part Numbers
PC	N-4850PCI-2	3*	3ft* (0.91m)	Included with PCI unit
Modem	N-485-HUB-2	3**	3ft** (0.91m)	Included with HUB unit
N-485-API-2 Data	N-1000	4	2ft (0.61m)	NC1821-GR
N-485-API-2 Power	N-1000	2	2ft (0.61m)	NC1821-OR
Multi-Dropline 485 Communications***		2	4000ft (1219m)	NC2021-GY- A Non-Plenum NCP2021-WH-A Plenum

Note: ** The N-485-PCI-2 includes a DB-9 female connector to plug directly into a PC. This cable is 3ft (0.91m) long.*

Note: *** The N-485-HUB-2 includes a DB-25 male connector to plug directly into a modem. This cable is 3ft (0.91m) long.*

Note: **** For maximum communication performance, the multi-drop line's electrical characteristic should be: 120 ohm characteristic impedance, 20 picofarad/foot (or less) capacitance with overall shield and drain wire. Maximum cable length is 4000ft (1219m).*

Status Indicators

The ***Red LED*** turns on when the 485 transmitter is active. It should flicker on the PCI and API.

The ***Green LED*** is a status indicator controlled by software. In both PCI and API configurations, a normally operating unit will turn on the LED every 6 seconds for a duration of one second (6 seconds off, 1 second on).

When the unit is configured as a PCI, the green LED turns on and off at ½ second interval when it has detected a downed API. This represents an API that the PCI was polling and now is not responding to the poll. When the green LED flickers, it means that there is a degradation of the bus communications. Packets are still getting through but with difficulty.

When the unit is configured as an API, the green LED stays on continuously when the API has not found a panel attached to it at the same address and/or baud rate as its dip switch settings. When the panel is found, the API controls the LED as described above (6 seconds off 1 second on). When the API has lost contact with its PCI, the green LED turns on and off at a ½ second interval. When the green LED flickers, it means that there is a degradation of the bus communications. Packets are still getting through but with difficulty.

The Amber LED is normally on when the 485 device is configured as an API. This is true even if the polarity of connection is reversed or the wires are shorted. The LED flashes off when the API is transmitting data to the panel. The panel's amber LED flashes off when it is transmitting to the API. If the 20 mA loop from the panel to the API is wired with reverse polarity, the panel's amber LED will remain off.

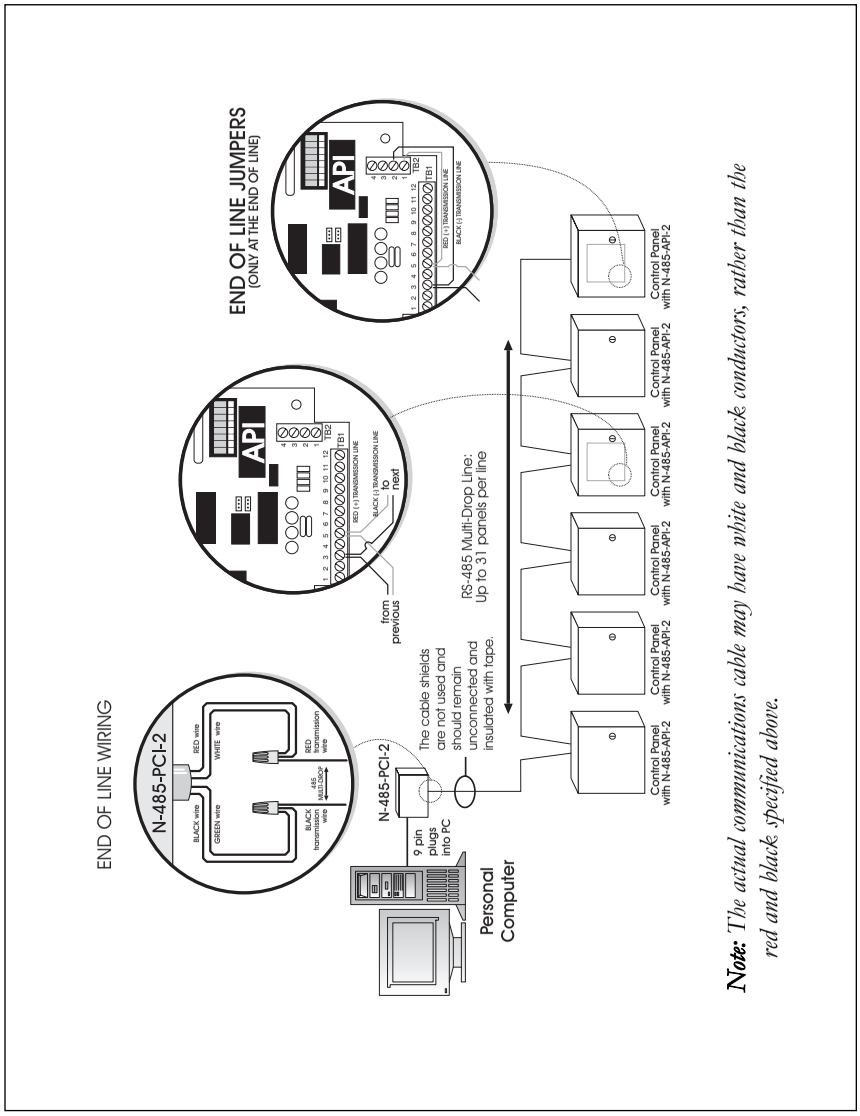
When the 485 device is configured as a PCI or HUB, the amber LED turns off when data is being transmitted out of the RS-232 port.

System Configuration

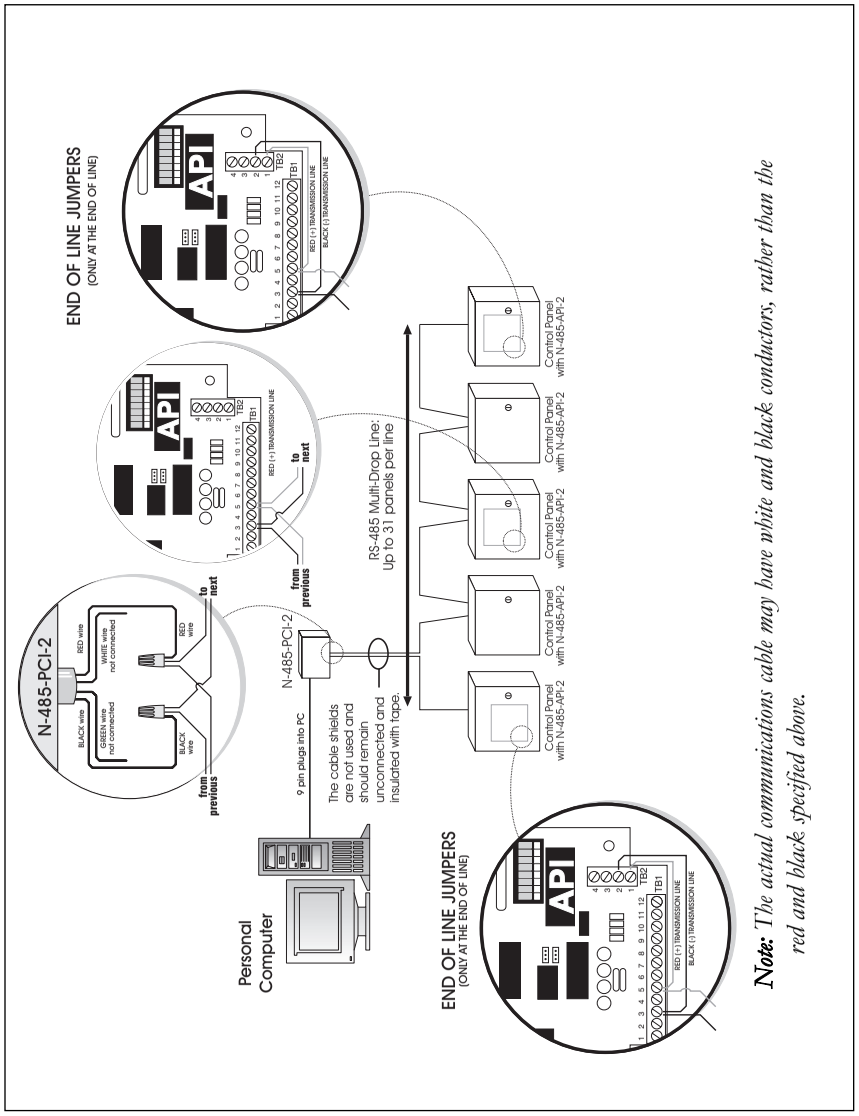
Illustrations on the next four pages show different configurations using 485 communication controllers on a multi-drop line.

- Configuration 1 illustrates an N-485-PCI-2 at one end of the line and a panel at the other end.
- Configuration 2 illustrates panels on both ends of a multi-drop line with the PCI in the middle.
- Configuration 3 illustrates a HUB using modems.
- Configuration 4 illustrates how to wire the 485 cable and N-485-API-2 power if electrical noise problems (due to widely separated earth grounds) are suspected of causing communication errors.

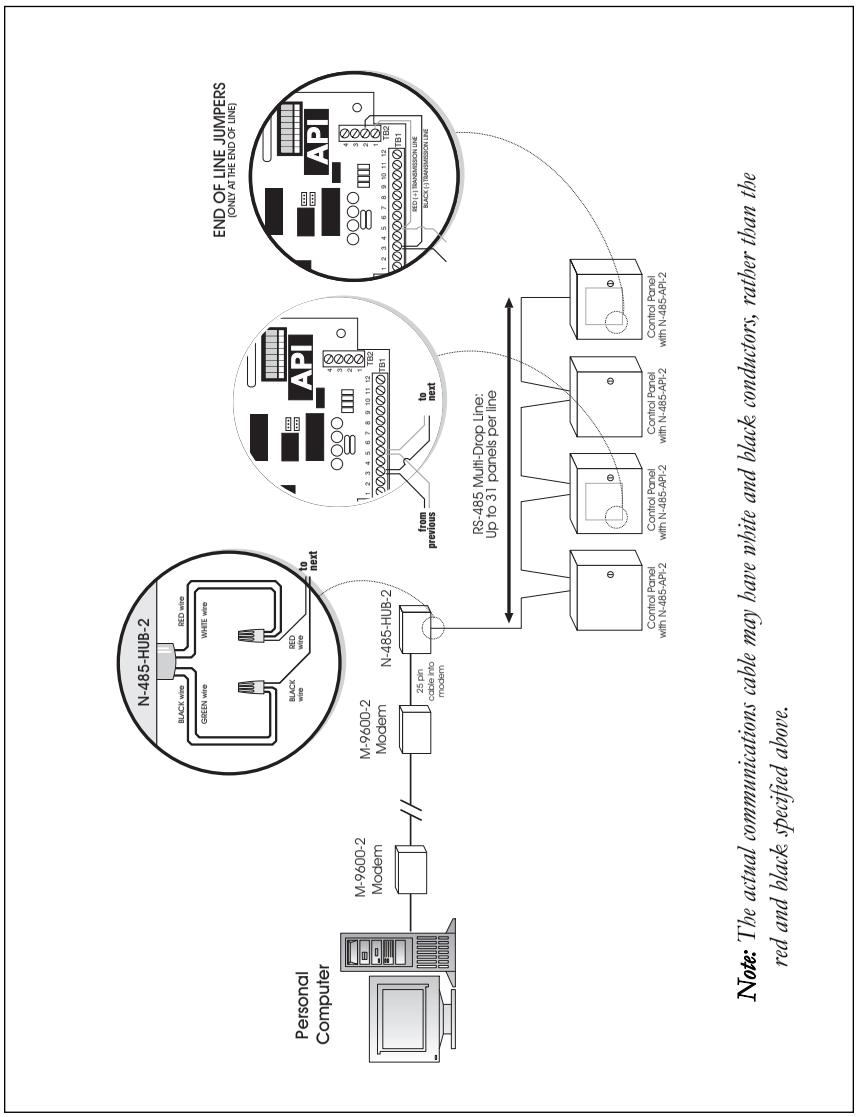
Configuration 1: N-485-PCI-2 at one end of multi-drop line with panel at other end



Configuration 2: Panels at both ends of multi-drop line

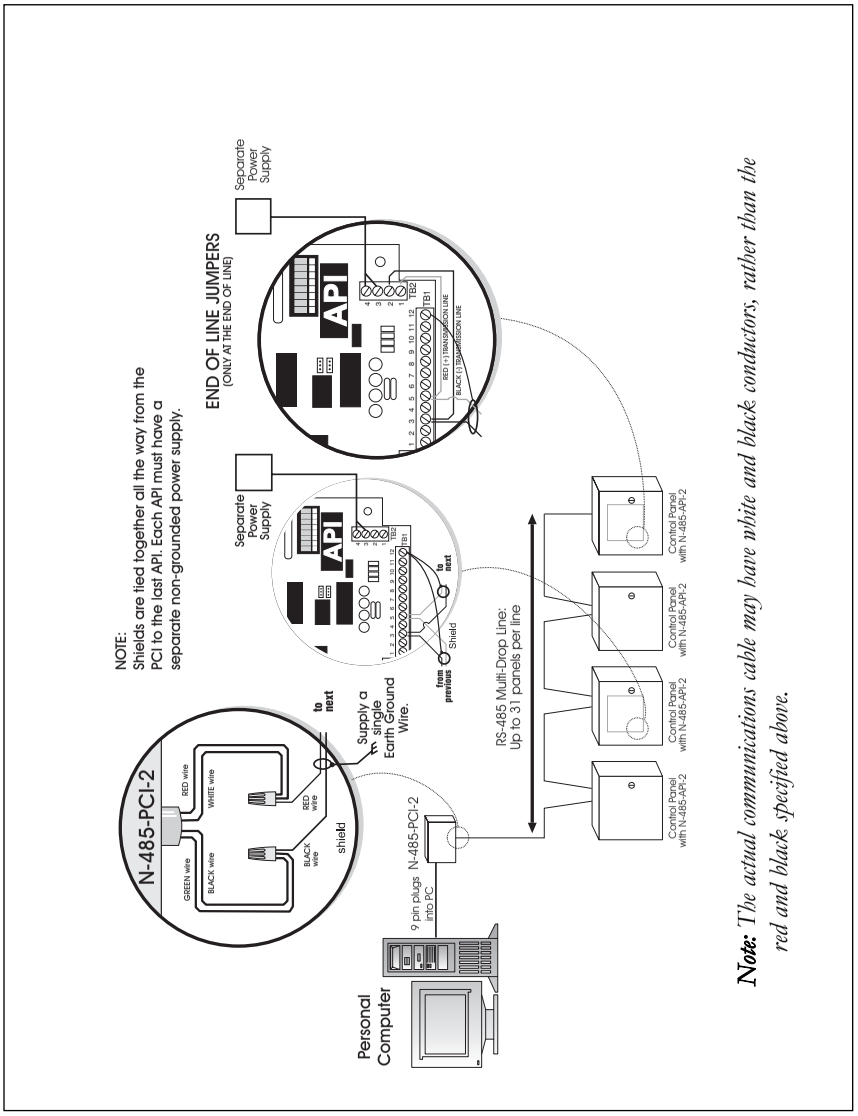


Configuration 3: Modem Dial-up

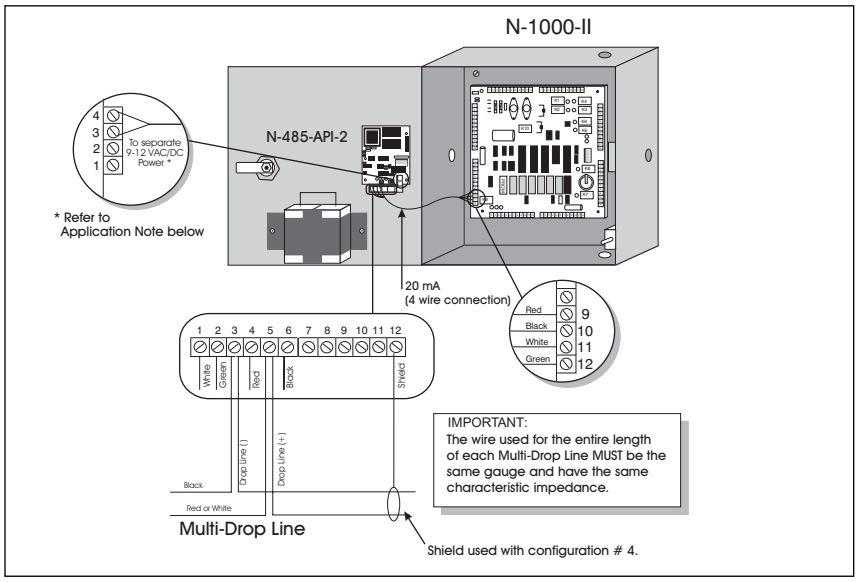


Note: *The actual communications cable may have white and black conductors, rather than the red and black specified above.*

Configuration 4: Special 485 cable wiring for panels in electrically noisy areas



N-1000 Panel & N-485-API-2 Wiring Diagram



Note: *The actual communications cable may have white and black conductors, rather than the red and black specified above.*

Note: *There is no on-board RAM backup on the API, PCI, or HUB. Northern recommends the use of a battery backup power supply as the API will not retain history transactions while power is removed from the API.*

- *When using AC power on the API, Northern recommends that a command file be created and sent to the control panel to buffer the panel on primary power loss.*
- *Use the following command file for version 7.0/7.3 firmware:*

  _V=pn_I_8_Ø_Ø_B_X

- *Use the following command file for version 7.46 firmware:*

  _V=pn_I_19_Ø_Ø_B

- *Use the following command file for version later than 7.46 firmware:*

  _V=pn_I_8_Ø_Ø_B

Note: *pn represents panel number, _ represents a space.*

Reports

The PCI and API support an extensive suite of diagnostic reports. All reports can be solicited from the PCI by typing CTRL+A (^A), then entering the corresponding code for the desired report. For example, to display the Node Map Report (show below), type: CTRL+A, 0, M.

^A0M: Node Map Report

```
NODE MAP
00000000011111111112222222222233  *Read address top to bottom. First column 01
12345678901234567890123456789012    is panel 01, second column 02 is panel 02 etc.
A-AAAAAAAAAAAAAAA [ spaces blank ]  *1st status line
P-PPPPPPPPPPPPPPP [ spaces blank ]  *2nd status line
```

First status line:

Where A means the API is alive.

Where - means the API was alive and is no longer responding.

Where ‘ ‘ means the API was never alive.

Second status line:

Where P means the panel is responding to API poll.

Where - means the panel is not responding to API poll.

^A0P: Abbreviated Node Map Report

P1111111000000000000000000000000
B1100011000000000000000000000000

First status line:

Where P is the poll response line.

Where 1 means the panel is online, responding to API poll.

Where 0 means panel is not online, not responding to API poll.

Second status line:

Where B is the buffer mode status line.

Where 1 means panel is buffered.

Where 0 means panel is unbuffered.

Note: *The abbreviated node report shown above indicates that seven panels are online responding to API poll. Panels 1, 2, 6 & 7 are buffered. Panels 3, 4, & 5 are unbuffered. The zeros after position seven are placeholders. The report displays 31 places even if there are fewer panels.*

^A0S: PCI Status Report

Address 0
Major vv Minor rr Interim ii
Date dd-mm Time HH:MM
Polls/Second: xx
Acks/Second: xx
Packet Retries: xx
Dup Invoices: xx
Bad CRC: xx
Bus Collisions: xx
Bus Framing Errors: xx
PC Bad Packet: xx

vv is the Major release number of the PCI Prom.

rr is the Minor release number of the PCI PROM.

ii is the Interim release number of the PCI PROM.

dd-mm is the Day and Month.

HH:MM is the hours and minutes.
The time and date set to 0 means that a time and date command have not been sent from the head-end software since the last PCI reset.

Polls/Second is how many times has the PCI polled all nodes.

Acks/Second is how many times the APIs have responded. Polls and acks should be the same or at most differ by one.

Dup Invoices is how many retries the API has sent. This count typically means that the API did not correctly receive the PCIs acknowledgment to its sent packet. The PCI throws away the duplicate packet.

Bad CRC means that a corrupt packet was detected while being received. The corrupt packet is thrown away and this counter is bumped once.

Bus Collisions means that the byte sent out onto the bus was not the same as the byte that was reflected back by the 485 hardware.

Bus Framing Errors means that the byte got bashed by noise and the UART flagged this error.

PC Bad Packet means that the PCI did not have enough space to handle the incoming command packet and has thrown it away.

^AppS: API Status Report (where pp = panel number, ^A1S = panel 1)

Address xx
Major vv Minor rr Interim ii
Date dd-mm Time HH:MM
Polls/Second: xx
Packet Retries: xx
Dup Invoices: xx
Bad CRC: xx
Bus Collisions: xx
Bus Framing Errors: xx
PC Bad Packet: xx
L4 Q Loading->Free: xx
API Found Address

vv is the Major release number of the API Prom.

rr is the Minor release number of the API PROM.

ii is the Interim release number of the API PROM.

dd-mm is the Day and Month.

HH:MM is the hours and minutes.
The time and date set to 0 means that a time and date command have not been sent from the head-end software since the last PCI reset..

Polls/Second is how many times has the PCI polled this API node.

Dup Invoices is how many retries the PCI has sent. This count typically means that the PCI did not correctly receive the APIs acknowledgment to its sent packet. The API throws away the duplicate packet..

Bad CRC means that a corrupt packet was detected while being received. The corrupt packet Is thrown away and this counter is bumped once.

Bus Collisions means that the byte sent out onto the bus was not the same as the byte that was reflected back by the 485 hardware.

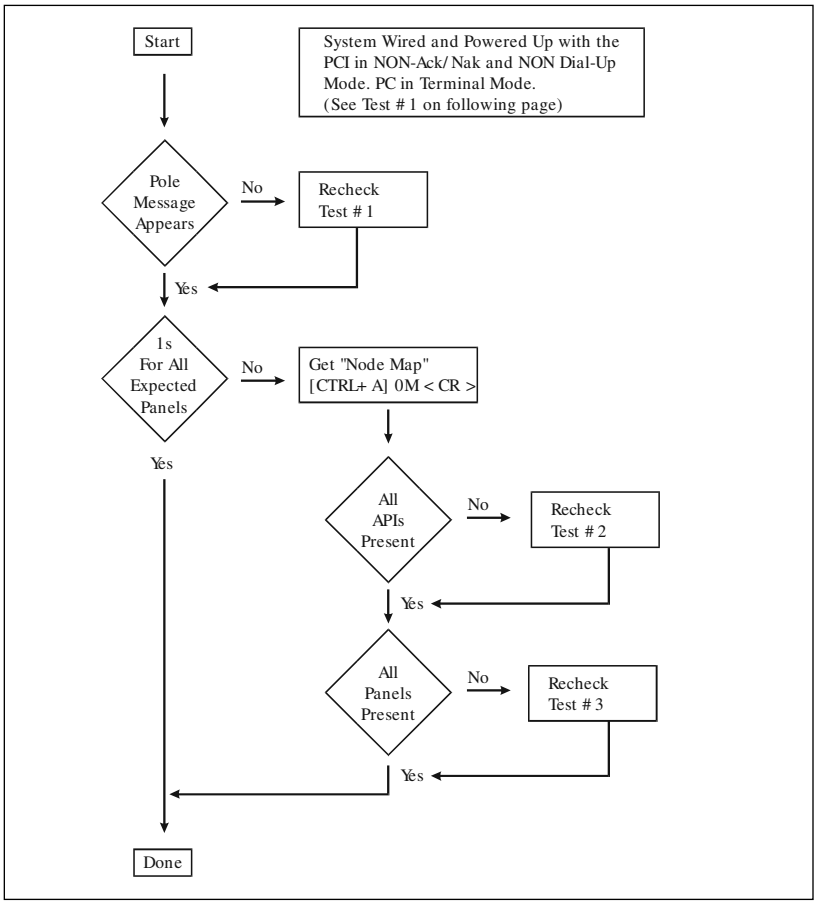
Bus Framing Errors means that the byte got bashed by noise and the UART flagged this error.

PC Bad Packet means that the API did not have enough space to handle the incoming N-1000 packet and has thrown it away.

L4 Q Loading -> Free indicates number of intermediate layer 4 packets or those packets that require acknowledgment, are free.

API Found Address means that the API received a valid response to its panel poll. The polling command (M=xx K) is used. If the panel responds, it means that the API is set to the same address.

485 Troubleshooting Guide



Test #1: Power-Up Message

For ease of troubleshooting, deactivate the ACK/NAK and the remote dial-up modes from the PCI (by setting dip switches 5 & 6 to the closed position). Reset the PCI in order for the new switch setting to take effect.

The PC should be connected to a terminal emulation program. Make sure that the baud rate of the PCI matches the baud rate set in the terminal emulation program.

- PCI dip switch 8 closed = 9600 baud
- PCI dip switch 8 open = 19200 baud

When the PCI is first powered up or reset a message will appear:

TESLA Master M 1 m 0 I 0

"TESLA Master" indicates that it is a message from the PCI. "M 1 m 0 I 0" indicates that the version of the PCI is 1.0.0.

If the message does not appear upon a power up or reset of the PCI:

- Verify that the PCI is good: Green LED should be blinking slowly or flickering at ½ second intervals. Red LED should be flickering indicating that it is polling.
- Verify correct PC to PCI wiring: Check the wire first to ensure the proper pinout. Jumper(s) may need to be installed to activate the Amber LED.

  Jumpers:

  • JP-2 jumper positions 1 & 2.

  • JP-5 jumper positions 1 & 2.

Test #2: Things to check if missing APIs

Checks from the PC

Get the PCI Status Report: [CTRL+A]Øs<CR> . See information on this report in the reports section of this manual.

When idle (not reporting transactions) the number of polls per second should be between 70 and 170, depending on how many nodes are online.

- A report between 60 and 70 polls/second indicates the low end (1 or 2 nodes).

- A report between 150 and 170 polls/second indicates the high end (30 or 31 nodes).

If polls/second is low (e.g., 0-50):

- Two or more APIs could be at the same address.
- API address may be out of range of (1-31). Eg: May be set to 64.

If polls/second is OK, but still missing APIs:

- The API could be bad or not powered up.
- There could be a problem with the BUS (Drop Line or Trunk Line). Refer to "Trunk Line Wiring Test" section.

Checks at the APIs

Check that the API number dip switches (3-8) are unique for every API. If a change is made, reset the API in order for the new switch changes to take effect.

Check the API jumper settings: JP-2 must be set to 1 & 2, JP-5 set to 2 & 3.

Check the status LEDs on the API(s) in question:

- The red LED should be flickering to indicate the API is being polled by the PCI. If the red LED is off, this indicates that the API is not talking to the PCI.
- The green run LED should be flashing slowly to indicate that the API is running properly. If it is flickering at ½ second intervals the wiring of the bus may be incorrect. See note on "Trunk-Line Communications". If it is on steady the dip switches of the API may not match that of the N-1000 panel it is wired to. (This problem is unrelated to a missing API, but could indicate other problems.)

Check the API to bus wiring. See note on "Trunk Line Communications".

Reset the API in question. Whenever the API is reset or powered-up, a message from that API should appear:

TESLA Slave 6 M 1 m 0 I 0

"6" is the API and N1000 II panel addresses. "M 0 m 2 I 5" indicates the version of the API is 0.2.5.

Test #3: Things to check if panels are missing

At the PC

-M=pn K should return an OK for every panel online and communicating.

At the API

If the green LED is on steady, the API did not find the panel address. Verify that the N-1000 panel dip switches are set the same as the API switches. They should match switch for switch.

- Baud rate switches: 1 & 2
- Address switches: 3-8

Check 20ma wiring from API to panel: The amber LED on both the API and N-1000 panel should be on, indicating proper 20mA wiring. The API amber LED will flicker when information is transmitted to the N-1000 panel. The amber LED on the N-1000 panel will flicker when information is transmitted to the API.

If the amber LED on the N-1000 panel is off, this indicates that the 20ma loop wiring is backward (TB7 11 and 12 on the N-1000 panel is reversed). The amber LED on the API will not go out, if the 20mA wiring on its side is reversed (TB7, 9 & 10 on the N-1000 panel).

Check power to the N-1000 panel.

Check that the run light in the N-1000 panel is flashing.

Try pressing the reset control on the N-1000 panel.

Trunkline Wiring Test

1. Power-off every API and PCI on the trunkline. Take an ohm meter and measure the total amount of resistance between the negative (-) and positive (+) terminals on the trunk line. This measurement can be taken anywhere on the trunkline. Because there are two 100-ohm resistors in parallel, in addition to the resistance of the cable, the resistance should read between 45 and 55 ohms.

Is the resistance between the negative (-) and positive (+) terminals between 45 & 55 ohms?

YES: Check the following:

- Check for crossed wires (+ and - reversed).
- Pull on all connections looking for loose wire.
- Check power to APIs (brownout).

NO: Check the following:

- Less than 40 ohms: + and - shorted together or grounded wire.
- 60-120 ohms: break in line, or missing end-of-line resistor.
- Greater than 120 ohms: break in line or no end-of-line resistors.

2. Power-off every API and PCI on the trunk line. Unplug the RS-232 cable from the PC. Take an ohm meter and measure between the positive (+) trunk line and ground. The resistance should read infinite. Measure between the negative (-) trunk line and ground.

Is the resistance between the negative (-) trunk line and ground infinite?

YES: There are no shorts or grounds.

NO: Check the following:

- Unplug the RS-232 cable from the PC.
- Check for wires shorted to conduit or grounds.

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