The Rest of the Story

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# Table of Contents

THE REST OF THE STORY ......................................................................................................................... 3

1.0 GLOSSARY ........................................................................................................................................... 3

2.0 TESTING, TROUBLESHOOTING, & DIAGNOSTICS ........................................................................ 14

2.1 TROUBLESHOOTING RTU PROBLEMS ......................................................................................... 14
  2.1.1 RTU is dead: no lights or voice ................................................................................................. 14
  2.1.2 RTU appears either dead or “locked up” .................................................................................. 14
  2.1.3 RTU turns itself ON, a few seconds after having been turned OFF ........................................ 16
  2.1.4 RTU seems OK, but will neither answer, nor dial out on phone line ..................................... 16
  2.1.5 RTU answers incoming calls, but does not reach dialed number .......................................... 17
  2.1.6 RTU dials out, but will not answer incoming calls .................................................................. 17
  2.1.7 RTU will not go into alarm when it should ............................................................................. 18
  2.1.8 RTU does not go into Communications Alarm when it should ............................................. 19
  2.1.9 RTU keeps calling when it should not .................................................................................... 19
  2.1.10 Cannot Establish Com Port (serial port) Connection ............................................................. 19
  2.1.11 Communications Alarms occur repeatedly ........................................................................... 19
  2.1.12 Failed Network Communications ....................................................................................... 20
  2.1.13 Corrective Action to Resolve File System Full Condition ..................................................... 21
  2.1.14 PLC Related Errors ............................................................................................................. 22
  2.1.15 Self-Test on Network ........................................................................................................... 23

2.2 NETWORK DIAGNOSTICS VIA KEYCODES ................................................................................ 24
  2.2.1 Report All Network Diagnostic Statistics for All Networks .................................................. 24
  2.2.2 Instantaneous Communications Status for Channel ............................................................... 26
  2.2.3 Channel Communication Errors ............................................................................................ 26
  2.2.4 Network Diagnostic Capabilities ............................................................................................ 26
  2.2.5 Destination Diagnostic Report ............................................................................................... 27
  2.2.6 Perform a Diagnostic Self-Test on Device’ ............................................................................ 27
  2.2.7 Self-Test on Network ............................................................................................................. 27
  2.2.8 List All the Nodes in Communications Failure ....................................................................... 28
  2.2.9 Diagnostic Codes Translation List .......................................................................................... 29

2.3 MAINTENANCE AND TESTING ...................................................................................................... 32
  2.3.1 Battery Replacement .............................................................................................................. 33

3.0 CUSTOMER SUPPORT ...................................................................................................................... 34

3.1 BEFORE CALLING CUSTOMER SUPPORT ................................................................................ 34

3.2 PHONE TECHNICAL SUPPORT PROCEDURES ........................................................................... 34

3.3 CUSTOMER TECHNICAL SUPPORT ............................................................................................ 34

3.4 SERVICE REQUIREMENTS .............................................................................................................. 35

3.5 RETURNING RACO PRODUCTS TO THE FACTORY .................................................................... 35

3.6 SOFTWARE PROBLEM REPORT .................................................................................................... 36

3.7 FCC NOTICE TO USERS ................................................................................................................ 37

4.0 FLOOBYDUST ...................................................................................................................................... 38

4.1 ADJUSTING CATALYST’S INTERNAL SPEAKER VOLUME ............................................................ 38

4.2 EXTERNAL SPEAKER CONNECTIONS ......................................................................................... 38

4.3 PLC WATCH-DOGGING OF RTU .................................................................................................. 38

4.5 INTEGRATING THE CATALYST AND ANALOG CELLULARM .................................................... 39
  4.5.1 Setting Session Delays ............................................................................................................. 40
  4.5.2 Using Keycodes from the Front Panel .................................................................................... 42
  4.5.3 Optimizing Data and Fax Transmission .................................................................................. 42

4.6 INTEGRATING THE CATALYST AND A DIGITAL CELLULARM SYSTEM ................................. 44
  4.6.1 Limitations when using the Catalyst and a Digital Cellarm System ....................................... 47

4.7 INTERFACEING THE CATALYST AND THE AUTOMATION DIRECT TERMINATOR I/O ............. 48
  4.7.1 Setting the Catalyst Modbus Port Parameter .......................................................................... 48
  4.7.2 Terminator I/O Base Controller Settings .............................................................................. 49
  4.7.3 Modbus Address Mapping ..................................................................................................... 49
  4.7.4 Catalyst Scaling for Terminator I/O Analog Channels ............................................................. 49
ACKNOWLEDGMENT  The act of advising the Catalyst (RTU) that the alarms message has been heard. Acknowledgement is accomplished by either pressing a designated touch-tone digit, or by calling the RTU back after the alarm call has ended. The ability to do this is dependent upon PIN configurations. Once acknowledged, further activity on that particular channel will not cause further dialing until the expiration of the Alarm Reset Time.

ALARM REPORT  A channel status report that is delivered to eligible destinations whenever an Unacknowledged Alarm condition exists. The Alarm report is a component of the Notification report. The alarm report includes alarm status information for linked channels when a violation condition persists for the entire trip delay period. Upon initiating an alarm report, the RTU will report only those linked channels that are currently in alarm status.

ALARM RESET TIME  The period of time, beginning at the moment an alarm is acknowledged, during which alarm dialing on behalf of that specific channel is suspended, regardless of further activity of its input circuit. At the end of the period, the Acknowledged Alarm status is cleared for that channel. Thus, if an alarm criteria violation still exists at that time, a new Unacknowledged Alarm will be created and a new series of alarm calls will be placed.

ALARM TRIP DELAY  The time required for an input violation to remain continuously in violation, before the channel trips into the Unacknowledged Alarm state.
ALARM VIOLATION CRITERIA  This is the configuration setting for a given channel that establishes what value, or condition, constitutes an alarm violation. The available choices depend upon channel data type (analog, discrete, physical, etc.) For example, if a channel with discrete data type is configured with an alarm violation criteria of "Alarm on 0", then whenever the channel's value is 0, a violation is considered to exist. If the violation remains in place for the duration of the configured alarm trip delay, an Unacknowledged Alarm state will be created for that channel. For any given channel, the alarm violation criteria can also be set to give an alarm only when there is a communications failure for that channel, or never to give an alarm (status only), or even to turn off (disable) the channel entirely so that it effectively does not exist.

ALARMWARE™  Windows-hosted software used to configure the RTU. May also be used to receive alarm, event, and data logging information from the RTU. Provision is made for ALARMWARE™ to be used on a portable computer, temporarily connected directly to a serial configuration port on the RTU, or remotely via modem.

ANALOG  Analog signals have variable values of current or voltage, with the specific value generally representing some physical parameter such as water level or pressure. The most common type of analog signal is 4-20 ma current loop, with a transmitter (transducer and associated power supply) governing the current in a loop. This current is detected by one or more receiving devices in the loop, such as a PLC.

ALIASING  In pulse generation, aliasing is the generation of a false (alias) frequency along with the correct one when doing frequency sampling.

APS  Allen-Bradley's Advanced Programming Software.

AUTOCALL  A special test calling function. When Autocall is turned on, the RTU places test calls at regular intervals to provide ongoing assurance of RTU and phone line operation.

AUTODIALER  A device that constantly monitors a set of inputs from various external sensors, and places outgoing alarm calls when there is an alarm condition. It also allow inquiry calls. Also referred to as an RTU (Remote Telemetry Unit) or Dialer.

CALL OUT  The action of the RTU placing calls to outside personnel or facilities.

CALL IN  The action of calling a RTU from a telephone line. Includes OTP, Alarmware™, and Log File download sessions.

CHANNEL  A channel consists of:
1. A channel number.
2. A data value.
3. A SNA (Source Network Address) from which to obtain the value reading.
4. Parameters about what sorts of values to treat as alarms (alarm violation criteria).
5. Information about how to process alarms (Annunciator sequence parameters).
6. How to announce the channel's status (messages).

**CHANNEL NUMBER**

The channel number is an ordinal number used to identify a particular channel. You can assign data points to channels in any way desired. Channels with the lowest numbers are reported first. Exception: the RTU can be configured to report based upon lowest Destination number first. Any channel can get data from any source.

**CHANNEL SOURCE NET ADDRESS**

The Channel Source Net Address (SNA) specifies from where the channel data comes. Every active channel must have a SNA. Possible sources include:
- Local Hardware (Physical I/O channels)
- Industrial Networks (PLCs)
- Internal Data Tables
- Other Channels

**CHANNEL DESTINATION NET ADDRESS**

The optional Channel Destination Net Address (DNA) specifies a location to which to direct the transformed channel data. Unlike the SNA, channels do not need to have DNA's established. Possibilities here are the same as for the SNA. This capability provides for channel linking. Factory default is no DNA.

DNA's should not be confused with destinations. Destinations receive reports only upon occurrence of certain conditions, while DNA's are continuously updated with the value of the channel configured with the DNA, at the RTU's scan rate.

**CLOSED CIRCUIT CONDITION**

One of two possible states of a contact closure input circuit. This would most commonly apply to the Physical input channels, rather than channels which get their data from a network address. **Closed Circuit** is the condition in which the contacts complete the electrical circuit connection. **Open Circuit** is the opposite condition, in which the contacts do not complete the electrical circuit connection. The Open Circuit condition is electrically equivalent to having no connection to the input circuit. A closed circuit on a physical input channel will measure zero volts DC from the input connection to the common connection point. An Open Circuit input channel will measure 5 volts DC.

**COMALARM**

Communications alarm. Network Communications failed for the duration of the communications alarm trip delay.

**COMMON**

This is the combined electrical return connection point for all contact closure inputs, for physical channels. One side of all contact inputs are connected to Common. Physically, this Common connection point is any of the 4 terminals marked C on terminal strip P7. The circuit board internally connects Common to the enclosure ground.
**CONTACTED**  In the area of notification sequencing, the term "contacted" refers to a destination answering the phone. No acknowledgement is needed to satisfy the RTU, just the act of answering the phone.

---

**DATA TRANSFORMATION**  The optional data transformation parameters define how the default channel data converts to the value used for reports, and alarm condition comparisons. These parameters support:
- Analog Scaling
- Gain and Offset

**DCS**  Distributed Control System.

**DEFAULT**  Configuration values which are built into the RTU, and remain in effect until an operator alters them. Also includes, permanently available speech messages, which are utilized when an operator has not recorded any messages.

**DEFAULT VALUE**  The initial factory setting of a configurable parameter.

**DESTINATION**  A Destination is a location that can receive reports. A Destination is generally a phone number, but other possibilities exist. They include:
- Pagers (numeric, beeping, and alphanumeric)
- Local Printer (LDL)
- Remote Data Terminals (RDT)
- Log file
- Central Station SCADA (available with S models only)

**DESTINATION CHANNEL GROUPING**  Special programming established to cause specific input channels to notify only selected destinations. Typically used to provide separate alarm functions, according to category of personnel, such as maintenance, security, plumbing, etc.

**DESTINATION NUMBER**  The Destination Number is used to determine which destination is notified about an alarm condition. When there is an alarm on a given channel, report delivery attempts are made to destinations which are eligible for that channel (based upon any Destination Channel Grouping), with the lowest Destination numbers first. Therefore, you have complete control over annunciation priorities.

**DIALER**  See Autodialer or RTU.

**DNA**  See Channel Destination Net Address.

**DRY**  Description of a sensor contact circuit that is not connected to any power source.

**DUTY CYCLE**  Duty cycle is the proportion of time during which a component, device, or system is operated. The duty cycle can be expressed as a ratio or as a percentage. Suppose a pump operates for 1 second, then is shut off for 99 seconds, then is run for 1 second again, and so on. The pump runs for one
out of 100 seconds, or 1/100 of the time, and its duty cycle is therefore 1/100, or 1 percent.

**E**

**F**

**FIRMWARE** Firmware is the operating code (similar to software in a computer) which controls the operation of the microprocessor system in the RTU. It is stored in part of the Flash memory system in the RTU. It remains fixed except for special occasions when an update of the firmware is done in order to incorporate improvements, or include new features. Firmware updates are made using Alarmware™ and the .rfw file provided.

**FLOOBYDUST** Miscellaneous. A contemporary term derived from the archaic Latin *miscellaneous*, whose disputed history probably springs from Greek origins (influenced, of course, by Egyptian linguists) -- meaning here "a mixed bag."

**FRONT PANEL (FP)** Includes Front Panel keys, microphone, speaker, and LEDs.

**FULL DUPLEX DF1** A particular variant of the DF1 protocol.

**G**

**GLOBAL** Essentially "over all" or "universal." Configurations that simultaneously sets the same value for all channels, or all destinations, etc.

**GROUPING** See Destination Channel Grouping.

**H**

**I**

**ID MESSAGE** A name that identifies the associated device. ID messages are configurable for:
- Destinations
- RTUs
- Networks
- PINs

**INDUSTRIAL NETWORK** A network using:
- DF1
- DH485
- Modbus
- Modbus Plus
- Other Industrial Protocol

**INQUIRY CALL**
A call placed by personnel to the RTU. Also known as a "Call-in."

**INTERSESSION DELAY**
The waiting time from the end of one attempt to reach a given phone Destination, until the start of the next attempt. Note that there may be multiple attempts to the same destination – according to configuration settings. During this interval, personnel may call the RTU back, which may acknowledge the alarm and suspend further calling.

**I/O**
Input / Output. A point, or channel, that senses or controls real-world devices.

**LED**
Light Emitting Diode. A lighted legend indicator on the front panel.

**LATENCY**
The measure of how long it has been since the value for a channel was last updated. Latency is affected by:
- Scan time (which in turn is strongly influenced by the number of active channels being scanned).
- Response time of the remote node.
- The occurrence of communications glitches.

**MESSAGE**
A voice or text phrase which conveys the status, of a channel or of the RTU. RTUs, Destinations, Networks, and PINs may be given names, and in that context the term "message" and "name" is used somewhat interchangeably.

Channel messages refer to the status of a channel. Note that the RTU appends Tag Words to channel status messages, so the messages should be planned with this in mind.

**MIME**
The name for the mail protocol used to handle attachments.

**MMI**
Man-Machine Interface

**MODBUS**
Non-proprietary industrial protocol allowing programmable controllers and other devices to communicate with each other over an RS-232C or Modbus

**MODEM** Modulator/Demodulator: A device which allows digital data (as opposed to voice data) to be transmitted between two sites, usually via public telephone lines. In the case of a RTU, a modem is built-in so that no external modem is required.

**MODSOFT** Modicon's controller programming software package.

**NETWORK** A collection of devices, called nodes, connected in a way that allows information to be exchanged between the nodes. Includes the physical and higher level protocols for a specific vendor's PLC data communications. The RTU can support a maximum of 3 networks simultaneously. The actual number of networks and types of protocols are hardware options, and software configurable.

**NET ADDRESS** The concatenation of the network number, node, and PLC data table address. It is sometimes symbolized by '/net/node/address' where:
- Net is the network number
- Node is the node address
- Address is the PLC address

The network address uniquely identifies any data object that the RTU can access. For the RTU's purposes, network addresses are generally Source Network Addresses (SNAs) or Destination Network Addresses (DNA's).

**NET NAME (ID) MESSAGE** A message (text or speech) identifying a specific network. By default, the message is "Net N," where 'N' is a number from 1 to 3. Custom speech messages may be recorded and custom text may be entered using Alarmware™.

**NET 1** Refers to devices connected to the “NET 1’ port on the RTU. *Protocol is Modbus.*

**NET 2** Refers to devices connected to the ‘NET2’ port on the RTU. *Protocol is Printer.*

**NET 3** Refers to devices connected to the "NET3" port on the RTU. *Protocol is Aware.*

**NODE** The address of a specific PLC node on the network. Each PLC is already configured with a unique integer as its node address. The RTU must also be given a unique number as its node address on each network to which it interfaces. The network number and node together suffice to uniquely identify any PLC.

**NORMAL CONDITION** For contact closure inputs, the Normal Condition is that condition (open or closed circuit) which normally exists. The opposite condition would create an alarm.

**NON-VOLATILE** All configurations and all user recorded messages are kept in flash memory.
**MEMORY**  which is completely non-volatile. Unit is not affected by power interruptions.

**NOTIFICATION**  The primary goal of the product is to notify operators of abnormal conditions, within specific operating parameters.

---

**OPEN CIRCUIT CONDITION**  
See *Closed Circuit Condition*.

**ORDINAL**  Ordinal numbers are used to indicate the “numerical order” of items such as input channels or destinations. From that standpoint, a channel number is really a channel ordinal number. Channel and Destination numbers determine the priority basis upon which alarm reports are delivered.

**OTP (Over the Phone)**  One of the ways to configure the RTU is by placing a phone call to it from a remote telephone. Once in PROGRAM mode over the Phone (OTP), configuration can then be performed via DTMF keys on the calling telephone.

---

**PAGING SYSTEM TERMINAL**  An automated system to receive numeric and alphanumeric text messages that will then be transmitted over the pager network to a specific pager device.

**PCRASH**  The term PCRASH is short for "Power Crash." A power crash is when there is an AC power failure and the battery backup has exhausted its power supply. The RTU will try to protect the following data by saving it just prior to the unit completely loosing power;
- RTU State (arm/disarm)
- Internal System Clock
- Channel States
- Channel Values
- Statistics and Counts

**PHYSICAL CHANNELS (PIO)**  Input channels that are associated with physical, point-by-point wiring connections. Physical channels are assigned to Net 0. By factory default until altered by the user, the first four channel numbers are the first four physical channels. These four physical channels are available for connection to dry (non-powered) contact closure inputs, or 5-volt logic levels, at terminal strip P7 on the main circuit board.

**PIN**  Personal Identification Number. Once configured, a PIN will be required to access the Dialer from OTP or ALARMWARE™™. PINs can be up to five digits long. Privilege level must also be assigned:
- Listen
- Acknowledge
- Program
- Administrator
The Rest of the Story

**PLC**
Programmable Logic Controller.

**PLC ADDRESS**
The data table location of an object within a specific PLC's internal memory. The format of the PLC address is vendor dependent. For Net 0, the "PLC address" is the physical channel number.

**POINT**
A source of data. Includes PLC registers, data table locations, IO, or channels.

**POWER FAILURE**
The disappearance of primary power to the RTU. The Dialer will continue to operate under power failure until its internal sealed lead-acid battery is discharged. A power failure alarm will be created if the failure endures for the configured power failure alarm trip delay.

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**Q**

**R**

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**RECORDING RATE**
In the process of digitally recording the User's voice messages into speech memory, the message is recorded into memory at one of two possible rates. The faster the rate of memory usage, the higher the recording quality, but the total available recording time is reduced correspondingly. 3600 bps is the factory default setting. 1800 bps is the other available rate, allowing more recording time.

**REMOTE DATA TERMINAL**
A kind of Destination consisting of a modem and computer which is running communication software, e.g. Procomm Plus. Used to download Log Files for permanent storage and data processing.

**REPORT**
A report is a sequence of messages intended to communicate complete information about a RTU state or configuration. The message sequence conveys the nature and extent of the report information.

**RING ANSWER DELAY**
The nominal number of rings required before the RTU will answer an inquiry call. Depending upon timing factors, any given inquiry call may be answered in one more or one less ring than the configured value.

**RTU (REMOTE TELEMETRY UNIT)**
A monitoring device, interfaced to a communication medium, whose mission is to communicate conditions from a remote or inaccessible site. A central computer on some schedule, or interval, usually polls RTUs. Additionally, RTUs may request polling to report any exceptions such as alarms or other
events that require the attention of the central computer or its operators. The Catalyst RTU is capable of receiving polling calls from a computer running Alarmware™ configuration software, a fax machine, or other type of communications software programs such as Procomm.

**RTU ID MESSAGE** A message that is always included in all calls made to or from the RTU, intended to identify the RTU, or its physical location.

---

**S**

**SCADA** Supervisory Control and Data Acquisition System.

**SCALE FACTOR** Scale and offset factors can be configured for analog input channels, to transform the raw reading into the desired end units.

**SESSION** Sessions occur between the RTU and a Destination. They consist of an exchange of information that is termed a report. An example of a session is what occurs when an RTU calls an operator’s phone number to deliver a voice report. Another example is when central computer calls an RTU for a Log File download. They are both sessions. Sessions have a beginning and an end. For example, a phone session with an operator starts when the RTU dials a phone number, and ends when either the operator or the RTU terminates the call.

**SNA** See Channel Source Net Address.

**SPEECH MEMORY RATE** See Recording Rate.

**STATE** The state of an input channel reflects additional information beyond its current reading status or value. From a conceptual standpoint only, the primary set of states for a channel are Normal, Alert, Alarm, Acknowledged Alarm, and Acknowledged Alarm, Now Normal. These primary states reflect the progress of an alarm condition:
- From the moment the violation is detected (Alert)
- To the moment the Alarm Trip Delay elapses (Alarm)
- To the moment the alarm is acknowledged (Acknowledged Alarm)
- Until the alarm reset time elapses and clears the alarm (Normal)
States are manifested in reports via the appending of Tag Words to the channel status messages.

---

**T**

**TAG WORDS** Supplemental words or phrases which are automatically appended to a report, that indicate the state of the channel or of the RTU. Tag words include:
- Normal
- Alarm
- Alarm, Acknowledged
- Now Normal
- Now Normal, Acknowledged
- Alert
- High Setpoint
- Low Setpoint
- DNA
- SNA
- Status Only

The factory default tag words can be reconfigured to whatever text and voice words that are appropriate for the RTU.

For additional information on Tag Words, please refer to the Operator's Manual section on Terminology and Concepts: Tag Word and States.

**TAP**
An abbreviation for Telocator Alphanumeric protocol. A communications protocol used to transmit simple text-only messages to a paging system terminal.

**TRANSITIONS**
The channel's current data value; the channel alarm conditions, operator actions, and the Annunciator all drive transitions between state sequence parameters. These parameters include; trip delay, acknowledgment, reset, lock-in, ringback, and first-out designations.

**TOD**
Time of Day

**WATCHDOG**
The Watchdog is integrated into the firmware of the RTU watching over all RTU activities. When the Watchdog detects that a process is not running as intended, it will initiate a firmware reboot. This will prevent any of the unit processes from being offline for more than 90 seconds.
2.0 Testing, Troubleshooting, & Diagnostics

2.1 Troubleshooting RTU Problems

2.1.1 RTU is dead: no lights or voice

**If the RTU will not respond to the Power ON/OFF key:**

*Note: Refer to section 2.5 RTU Interior View Diagram within the Installation Guide*

- Verify that the battery is connected.
- Verify that the main power fuse, F1, is not blown.
- Verify that there is primary power to the RTU. Verify that the yellow LED marked DC INPUT on the main circuit board is illuminated. *On the RTU Interior View Diagram, find the call-out labeled "PRIMARY POWER PRESENT LED."*
- If the RTU is powered via a plug-in voltage converter module, verify that the green LED on the module is lit. This would verify that voltage is being delivered to the output connector of the voltage converter module.
- If the product’s voltage regulator circuit is “turned on” the red LED labeled ‘VCC’ will be lit, indicating that even though the RTU seems dead, the product is turned on as far as the power supply circuit is concerned. *On the RTU Interior View Diagram, find the call-out labeled "PRODUCT TURNED ON LED."* (Do not confuse this single red LED with the array of six red serial port LED’s.)
- Verify that the front panel ribbon cable is properly seated on both the main circuit board and the front panel circuit board. Refer to the Interior View Diagram for a detailed view of the proper orientation of the front panel circuit board. This cable when properly plugged onto the front panel circuit board has the index color stripe arriving at the front panel circuit board with the index color stripe on the right hand side when the door is open.

2.1.2 RTU appears either dead or "locked up"

When the unit is behaving properly, there is a system watchdog that will automatically reboot the unit when it is dead for 90 seconds. If this feature is not performing, it may become necessary to clear down the unit to its factory defaults. Under certain unusual circumstances, data in certain register locations within the RTU’s flash memory module may become corrupted. If this occurs, the RTU may lock up or behave erratically.

- If the RTU will not respond to any front panel keys, e.g. Power ON/OFF, then the unit is considered "locked up."
- To regain control of the unit, first temporarily disconnect the battery by disconnecting the positive battery terminal.
- Next remove primary power by unplugging the unit.
- Next restore primary power to the RTU.
- The unit should boot automatically. If the unit performs as expected, then it may have only needed to be rebooted.
- Reconnect the battery terminal.
If the unit continues to act strangely, then a good practice would be to reformat the file system.

To reformat the unit, enter PROGRAM mode. For OTP and FP use keycode 93911 to reformat and reboot. For Alarmware™, use the Cleardown menu item.

The process can take several minutes. When done, the RTU should respond normally to pressing front panel keys.

If the unit continues to perform improperly, please contact your RACO representative.

After reformatting is complete:

- Restore your user configurations for this RTU, including recorded speech messages, by connecting to the RTU with Alarmware™ (via modem or preferably by local serial port connection).
- Alarmware™ will report a database mismatch.
- Select “Export Alarmware™ configuration to RTU”.
- Using local serial port connection at 57,600 baud, the length of time the configuration restoration process will take will depend upon how much speech data has been recorded and saved in the corresponding Alarmware™ configuration file.
- Any user configurations or recorded speech memory data, which was not previously saved in the Alarmware™ configuration file, will need to be re-entered as needed.
2.1.3 RTU turns itself ON, a few seconds after having been turned OFF

Check to see if a battery installed. If the battery is missing or completely dead, this behavior can occur. Also check to see that the front panel ribbon connector is properly seated onto its connectors on the main circuit board and the front panel circuit board.

2.1.4 RTU seems OK, but will neither answer, nor dial out on phone line

- This assumes that you hear a voice report at the Front Panel when you press CHECK STATUS.
- With the normal light lit, test the phone line by pressing DIAL-OUT. The PHONING light should light and you should hear a dial tone.
- If you do not hear a dial tone, open the door of the RTU and verify that fuses F1 and F2 (800 milliamperes) are not blown.
- Check the phone line and its connection with a DC voltmeter and/or a separate telephone handset.
- A live phone line should deliver approximately 50 VDC when the product is on hook. This voltage will drop to just a few volts when the product or other connected phone device goes off hook. Failure of this voltage to so drop when the RTU goes off hook indicates a likely blown fuse F1 or F2. The replacement is Bussman BK/GMC 800 ma or equivalent.
- If you do hear the dial tone after pressing DIAL-OUT, press the digits of a valid phone number. You should hear the clicks of relay (for pulse dialing) or else the tones of tone dialing, as you press each digit. The dial tone should cease after you enter the first digit. Continue until you have dialed the complete phone number. You should now hear the sound of ringing and someone answering at the other end.
- End the call by pressing NORMAL.
2.1.5 RTU answers incoming calls, but does not reach dialed number

RTU answers incoming calls, and also goes into alarm when it should, and attempts to dial out, but does not reach dialed number. First, verify whether the RTU is actually attempting to dial out, as evidenced by pulsed dialing clicks or tone dialing sounds, followed by message recital. If not, then see the separate problem below: Unit does not go into alarm when it should.

- Enter PROGRAM mode by pressing the PROGRAM key.
- Read the present mode by pressing keycode 40 7 and the ENTER key.
- Then set the operating mode by entering 40 7 *1 for TONE or 40 7 *0 for PULSE.
- Then press NORMAL and repeat the manual DIALOUT procedure.
- Verify that you have configured complete phone numbers including any area codes, or prefixes that might be required to complete the call.
- Consider whether your phone system requires a prefix such as 9 to be dialed, followed by a delay period (to access an outside phone line) before dialing out. One second delays can be added to phone strings by entering commas. Commas can be easily added to the dialing string with Alarmware™, or with a #5 when using keycodes.
- You can also try temporarily connecting a regular telephone to the line normally connected to the RTU, and see if you can successfully dial out to the same telephone number with that telephone. This would reveal whether there is a problem with the phone line, and whether the number the RTU is trying to dial is valid.

2.1.6 RTU dials out, but will not answer incoming calls

- Check configured ring delay by pressing PROGRAM 40 4 ENTER.
- If it is set for a number larger than one (1), the RTU is not supposed to answer until the corresponding number of rings has been received.
- Try setting it back to one (1) by using code 40 4 ** ENTER.
- If the RTU still will not answer incoming calls but is able to dial out, try plugging a regular telephone into the same phone jack in place of the RTU and see if it rings.
2.1.7 RTU will not go into alarm when it should

For the RTU to Transition into an Unacknowledged Alarm and Dial Out:

- A violation condition must be continuously present for the \textit{Alarm Trip Delay} period.
- At least one destination must be configured and eligible to receive notification calls.
- For a destination to be configured there must be a place for the RTU to get acknowledgment, a telephone number for example.
- For a destination to be eligible, it must be linked to the alarming channel.
- Destinations are always linked to all channels with the default settings from the factory, until the user establishes other linking.
- The RTU must not be in the \textit{DISARMED} state.
- Also, the channel that has the violation must not already be in an acknowledged alarm state, since acknowledged alarm status for a given channel (including power failure) precludes further activity on that channel until that status is cleared.

To clear the acknowledged alarm status of all channels including power failure:

- Starting with the NORMAL light lit, press DISARM/REARM to get the flashing DISARMED indication.
- Then press it again to re-arm the RTU with all acknowledged alarm status cleared.
- Now any violations lasting longer than the Alarm Trip Delay will cause unacknowledged alarms and dialing.
- The corresponding channel number flashing indicates unacknowledged alarm status.
- The same light remaining ON continuously without flashing indicates acknowledged alarm status.

If you do not observe this:

- Press PROGRAM.
- Then press 70 1 ENTER to check the phone number of destination 1.
- Press 80 1 to check the Common Trip Delay.
- If there is a specific channel that you are attempting to create an alarm on, also press 56 <Z> to check for any long single-channel Alarm Trip Delay setting.
- Check the Alarm Violation Criteria configuration for this channel by pressing 52 Z. Make sure it is not set to disabled or status-only, since these settings would not allow an alarm.

Example:

- If the channel Alarm Violation Criteria is configured for Alarm on 1 raw value, you will want to temporarily provide a logic 0 (or a closed circuit if using a physical channel) at its input to trip the alarm.
- You can directly read and verify the Open/Closed status you are applying to physical channels by using the Alarmware™ Check Status, or by using keycode 01 Z.
- Note that the physical channels are by factory default, the first four channel numbers. However, you may have changed these assignments in the course of configuring the RTU.
- You may also use a DC voltmeter to trace your physical input circuit connections. With the RTU turned ON, an Open Circuit to a physical input reads 5 volts DC with respect to the C terminals, or electrical ground. A Closed Circuit reads 0 volts.
The Rest of the Story  Testing, Troubleshooting, & Diagnostics

2.1.8 RTU does not go into Communications Alarm when it should

- The Communication Alarm Trip Delay may be set too high.
- Refer to the topic 2.2.2 Channel Operations Testing within the Rest of the Story.

2.1.9 RTU keeps calling when it should not

- Be sure that the initial alarm call is in fact being acknowledged. The RTU will specifically state "Alarms are acknowledged..." at the moment you successfully acknowledge the call. Press the Check Status key at the front panel or call the unit over the phone, to determine if all alarms are acknowledged.
- Also, be sure that the alarm violation has been corrected. Otherwise, even if the alarm is acknowledged, when the Alarm Reset Time period times out, dialing will begin again.
- Write down exactly what the RTU recites when it gives the unwanted call. This provides valuable guidance as to the cause and correction of the problem.
- You may need to lengthen the Alarm Trip Delay in order to minimize nuisance alarms, particularly the Power Failure Alarm Trip Delay (PFAIL).
- If you hear an alarm message with the phrase "Now Normal..." added at the end, it means that the violation occurred long enough to trip the alarm but has returned to normal by the time you are hearing the report.
- In the case of power failure lasting longer than the Power Failure Alarm Trip Delay, power will continue to be mentioned in any phone call or Front Panel Status Check, until the Alarm Reset time expires.
- Environmental factors such as lightning or power surges may have caused a program lock-up. If this is the case, then to return the RTU to normal operation, you will need to restore your configuration and speech data from Alarmware. If your data was not saved to Alarmware (see 2.17 Backing Up Your Data in the Operator’s Manual), it may become necessary to cleardown all parameters to its factory defaults. This is accomplished by entering key code 93911 when in PROGRAM mode.

2.1.10 Cannot Establish Com Port (serial port) Connection

- Verify that the com port settings are correct on each device. This includes the data speed setting.
- Verify that the cables are the correct type (see topic 2.12 Cable Diagrams in the Installation Guide) and that they are properly seated in the proper connectors (see topic 2.6 RTU Bottom View and Connectors Diagram in the Installation Guide). If available, try swapping with another cable.
- There are six LED’s on the main circuit board. For each of the three ports there is an RX LED indicating receive activity and a TX LED indicating transmit activity (see topic 2.5 Interior View Diagram in the Installation Guide).

2.1.11 Communications Alarms occur repeatedly

- Verify that cable connections are correct and secure.
If basic serial communications seem to be occurring on the industrial network, then the problem may be too low a setting for the communications alarm trip delay.

The amount of time communications with a specific channel may lapse is dependent on many factors. One of the main factors is how many channels are active. An RTU scanning 256 channels may require a com alarm trip delay of 200 seconds or more to avoid nuisance alarms.

One practical approach to determining a suitable initial setting for the com alarm trip delay is to query the RTU for the channel scan time with Keycode 9 0 2 N 1, where N is the Net number (usually 1). It is suggested that you configure twice that value for the communication alarm trip delay, which can be accessed using the Net 1 tab under Configuration | Devices in Alarmware™.

See also Topics:

- 3.1 Channel Operations Testing in the Installation Guide
- 2.1.12 Failed Network Communications in the Rest of the Story
- 2.10.3 Modbus Port Settings (Net 1) in Operator’s Manual
- 1.9.4 Scan Time and Channel Latency in the Operator’s Manual

2.1.12 Failed Network Communications

Whenever a channel poll fails, for whatever reason, it becomes impossible to determine if that channel is, in reality, violating its alarm violation criteria. Since most network problems are spurious and random, the next poll is likely to succeed. Persistent failures require some sort of notification. The term communications alarm is used to distinguish this situation from alarms based upon alarm violation criteria.

A channel will register a communications alarm violation whenever the following two conditions are met:

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>The channel is configured with an alarm violation criteria (e.g. cannot be set to &quot;status only or disabled&quot;).</td>
</tr>
<tr>
<td>2</td>
<td>The channel's latency exceeds the Network Communications Alarm Trip Delay Timer.</td>
</tr>
</tbody>
</table>

Once in violation, the communications alarm condition must then persist for the trip delay period before the alarm call sequence begins. The occurrence of a communications alarm tells personnel that there is a persistent network problem preventing access to channel data. It gives absolutely no indication of whether the point is violating the conditions or not. Still, for status reports, alarm calls, LED indicators and acknowledgments, a communications alarm is treated just the same as regular alarms.

Note: The communications alarm trip delay period is not combined with the violation criteria alarm trip delay period. The channel(s) will go into SNA alarm as soon as the communications alarm trip delay period times out.

If any channel configured on a given node is in the communications alarm state, the message depends upon the channel's analog/discrete data type:

<table>
<thead>
<tr>
<th>CHANNEL TYPE</th>
<th>COMMUNICATION ALARM MESSAGES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Discrete</td>
<td>&quot;Channel &lt;Z&gt; violation SNA Alarm&quot;</td>
</tr>
<tr>
<td>Analog / Floating Point</td>
<td>&quot;Channel &lt;Z&gt; reading is NO SCAN DATA SNA Alarm&quot;</td>
</tr>
</tbody>
</table>

To determine the Communications Failure Code:

<table>
<thead>
<tr>
<th>KEYCODE</th>
<th>COMMUNICATION REPORT MESSAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>
"Channel <Z.> The present communication status is Error Code xxx"

Where Z is the channel number, and xxx is one of the codes in the Diagnostic Codes List.

If all channels configured on a given node are in the communications alarm state the message is simplified to:

"Communication Failure at Node N"

Where N is the given node number

**Note:** If all channels on a Net are in communications alarm, then in addition to the corresponding channel LEDs being activated, the LED for the Net which it is on will also be activated.

**To determine the Communications Failure Code with Alarmware:**

Connect with Alarmware. The PLC LED should be blinking if there is a detected problem. Click on the blinking LED and the error codes are be listed.

2.1.13 Corrective Action to Resolve File System Full Condition

If the file system becomes completely full, it will become impossible to modify the RTU configuration. This condition will be reported via error codes, alarm messages or diagnostic reports.

**Operator intervention is required to resolve the condition as follows:**

- If configuring the unit, exit the current session. The automatic database cleaning function may free sufficient space to allow the next session to continue.
- Erase any single speech message. This should free up sufficient space to make a large number of configuration changes. Be sure to keep a full backup copy of all speech data used by the RTU.
- After the desired configuration changes are completed, attempt to restore the erased speech message. In rare cases it will be necessary to re-record a shorter version of the speech message.
- Reduce the amount of file system space reserved for the data Log Files. If this reserved space is currently utilized, it may also be necessary to download or otherwise erase the existing Log File data.
- If file system fills while recording speech messages and additional messages still need to be recorded, then:
  - Select a slower recording rate if possible.
  - Re-record messages speaking faster or using shorter phrases.

**Note:** It is recommended that the unit be fully configured BEFORE the speech messages are recorded.
2.1.14 PLC Related Errors

The remaining portion lists the values and interpretations for the most common network error situations. Note that some codes are derived directly from standard error codes supported by specific protocols. The documentation for those products is then necessary for interpretation.

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>No error condition detected</td>
</tr>
<tr>
<td>350</td>
<td>Net address entered incorrectly</td>
</tr>
<tr>
<td>351</td>
<td>Rc flag not recognized, attempt to write a read only address</td>
</tr>
<tr>
<td>352</td>
<td>Specified net is invalid</td>
</tr>
<tr>
<td>353</td>
<td>Packet did not fit in buffer</td>
</tr>
<tr>
<td>354</td>
<td>Protocol does not support the net address format</td>
</tr>
<tr>
<td>355</td>
<td>Protocol does not fit this data type</td>
</tr>
<tr>
<td>356</td>
<td>Request timed out with no feedback</td>
</tr>
<tr>
<td>357</td>
<td>Node address is invalid for selected protocol</td>
</tr>
<tr>
<td>358</td>
<td>Driver got into an unknown state</td>
</tr>
<tr>
<td>359</td>
<td>Node/driver incompatible with address mode</td>
</tr>
<tr>
<td>360</td>
<td>Miscellaneous error parsing address string</td>
</tr>
<tr>
<td>361</td>
<td>Some field was duplicated in address string</td>
</tr>
<tr>
<td>362</td>
<td>File type specified in address string no supported</td>
</tr>
<tr>
<td>363</td>
<td>Couldn't parse file number field in address string</td>
</tr>
<tr>
<td>364</td>
<td>Couldn't map the I/O slot specified in address string</td>
</tr>
<tr>
<td>365</td>
<td>Couldn't parse element field in address string</td>
</tr>
<tr>
<td>366</td>
<td>Couldn't parse sub-element field in address string</td>
</tr>
<tr>
<td>367</td>
<td>Couldn't parse bit field in address string</td>
</tr>
<tr>
<td>368</td>
<td>Too many routing nodes specified in address string</td>
</tr>
<tr>
<td>369</td>
<td>Some routing node has illegal syntax</td>
</tr>
<tr>
<td>370</td>
<td>Transaction aborted at user request</td>
</tr>
<tr>
<td>371</td>
<td>Hardware does not support the protocol</td>
</tr>
<tr>
<td>372</td>
<td>Alarm criteria flag not recognized</td>
</tr>
<tr>
<td>373</td>
<td>Error function called with no config error</td>
</tr>
<tr>
<td>374</td>
<td>Created/transmitted a null packet</td>
</tr>
<tr>
<td>390</td>
<td>Source channel data not available for channel link</td>
</tr>
</tbody>
</table>

**MODBUS-SPECIFIC ERRORS:**

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>410</td>
<td>No traffic received from the net</td>
</tr>
<tr>
<td>420</td>
<td>UART serialization error</td>
</tr>
<tr>
<td>430</td>
<td>Time-out with no recognizable response</td>
</tr>
<tr>
<td>431</td>
<td>Time-out with no response at all</td>
</tr>
<tr>
<td>440</td>
<td>CRC error</td>
</tr>
<tr>
<td>450</td>
<td>Valid framing, unknown command or response</td>
</tr>
<tr>
<td>500</td>
<td>Enqueued transaction not transmitted</td>
</tr>
<tr>
<td>501</td>
<td>Transaction took too long to transmit</td>
</tr>
<tr>
<td>502</td>
<td>Attempt to transmit a null packet</td>
</tr>
</tbody>
</table>
### MODBUS EXCEPTION RESPONSES:

The last 2 digits come directly from the MODBUS protocol exception responses. The occurrence of these codes is sufficient to conclude that the remote node received the command but could not execute it.

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>600</td>
<td>Offset for Modbus exception responses</td>
</tr>
<tr>
<td>601</td>
<td>Modbus exception: Illegal function</td>
</tr>
<tr>
<td>602</td>
<td>Modbus exception: Illegal data address</td>
</tr>
<tr>
<td>603</td>
<td>Modbus exception: Illegal data value</td>
</tr>
<tr>
<td>604</td>
<td>Modbus exception: Failure in associated device</td>
</tr>
<tr>
<td>605</td>
<td>Modbus exception: Acknowledge</td>
</tr>
<tr>
<td>606</td>
<td>Modbus exception: Slave device busy</td>
</tr>
<tr>
<td>607</td>
<td>Modbus exception: Negative acknowledge</td>
</tr>
<tr>
<td>608</td>
<td>Modbus exception: Memory parity error</td>
</tr>
<tr>
<td>609</td>
<td>Could not convert data to correct type</td>
</tr>
</tbody>
</table>

### DEVICE SELF-TEST CODES:

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>700</td>
<td>Device has not been opened</td>
</tr>
<tr>
<td>705</td>
<td>DUART not present</td>
</tr>
<tr>
<td>710</td>
<td>Net not configured with PLC-type protocol</td>
</tr>
<tr>
<td>715</td>
<td>Bad serial IO configuration parameter</td>
</tr>
<tr>
<td>725</td>
<td>Background noise on network substrate</td>
</tr>
<tr>
<td>730</td>
<td>Another Modbus master already active</td>
</tr>
<tr>
<td>731</td>
<td>MBPLUS peer in monitor-on-line state</td>
</tr>
<tr>
<td>732</td>
<td>MBPLUS peer never getting token</td>
</tr>
<tr>
<td>733</td>
<td>MBPLUS peer in unknown state</td>
</tr>
<tr>
<td>734</td>
<td>MBPLUS driver not responding</td>
</tr>
<tr>
<td>735</td>
<td>Diagnostic loop-back test failed</td>
</tr>
<tr>
<td>750</td>
<td>A remote node has same node address</td>
</tr>
<tr>
<td>755</td>
<td>Could not find any nodes on network</td>
</tr>
</tbody>
</table>

Note: See Modicon documentation for further details.

2.1.15 Self-Test on Network

Response to the self-test on a network will either be with **Normal...** or with the Error Code. All available network diagnostic counters and information will be reset. If a Printer device is configured, additional information will be printed.

**Modbus Note:** *During self-test, communication alarms may trip, but these alarms will be reset after exiting program mode.*

**Keycode Examples:**

- To do a Self-Test on Network N, press: 911 N ENTER.

**Alarmware™ Example:**

- To do a Self-Test on a Network, connect to the desired RTU and click Diagnostics on the main menu.
- Click the Network Diagnostics Self-Test checkbox from within the RTU Diagnostics dialog box.
- Click OK.
2.2 Network Diagnostics via Keycodes

2.2.1 Report All Network Diagnostic Statistics for All Networks

This function will report all the diagnostic information for all networks.

Diagnostic information includes:

- Network Status
- Network Alert Count
- Diagnostic Codes for the Last Ten Network Problems
- Active Nodes
- Scan Time
To list all active nodes on Network N, press: 914 N ENTER.

**Alarmware™ Example:**

To receive a Summary Report for All Network Diagnostic Statistics for a particular network, first connect to the desired RTU.
Click Diagnostics on the menu bar.
The RTU Diagnostics dialog is launched.
Select the Net Diagnostics -- Summary Report checkbox, and click OK.
Alarmware™ will upload the Net Summary Report to the RTU messages window.

### 2.2.6 Instantaneous Communications Status for Channel

This function enables you to query the RTU for the current communication status for a specified channel.
Function either reports normal status or the status error code.

**Keycode Example:**

To read the instantaneous communications status for Channel Z, press: 915 Z ENTER.
Alternately, you can use Alarmware to retrieve the information from its direct channel reading dialog.

### 2.2.7 Channel Communication Errors

This function enables you to query the RTU for the count of communication errors for a specified channel.

**Keycode Example:**

To read the count of communication errors for channel Z, press: 916 Z ENTER.
Alternately, you can use Alarmware to retrieve the information from its direct channel reading dialog.

### 2.2.8 Network Diagnostic Capabilities

The Catalyst RTU offers many features to help with the inevitable complexities of a networked environment.

**The following list gives a brief sketch of these capabilities:**

- Ability to perform end-to-end network-connectivity self-test (see 2.2.12 Network Diagnostic Self-Test in the Rest of the Story)
- May obtain a list of all nodes currently active on any net (see 2.2.6 Active Nodes in the Rest of the Story).
- Status reports and the Front Panel LED indicators announce the overall health of each network.
- May easily suspend and later resume all scanning activity on a specific net. This is useful for disabling alarms on one network, while still scanning the others.
Generate reports about communication diagnostics and history for any channel. This includes current status and communication alarm count.

2.2.9 Destination Diagnostic Report

The Destination Diagnostic Report contains diagnostic information for all stations. This information includes the date and time of the last session and the total number of sessions.

**Keycode Examples:**

- To get a report on all network diagnostic statistics for network N, use keycode 902 N.
- To read the number of nodes in comalarm, use keycode 902 N * 2 (all channels on each node must be in comalarm)
- To get network alert count, use keycode 902 N * 3
- To read diagnostic codes for last 10 network problems, use key code 902 N 4

**Alarmware™ Example:**

To get a Destination Diagnostic Report, connect to the desired RTU and click Diagnostics on the main menu. Click the Destination Diagnostic Report checkbox from within the RTU Diagnostics dialog box, and click OK.

2.2.10 Perform a Diagnostic Self-Test on Device:

- This function performs a diagnostic Self-Test on a specified device.
- This function will return communication test results (normal or error code) for Device.
- The Dialer will reset all available network diagnostic counters and information.
- If you configure a Printer device for reporting, there is additional information printed.
- This self-test may take a long time to complete.

*Note: MODBUS only: Communication alarms may trip, but will be reset when exiting program mode.*

**Alarmware™ Example:**

To get a Device Diagnostic Report, connect to the desired RTU and click Diagnostics on the main menu. Click the Device Diagnostic Report checkbox from within the RTU Diagnostics dialog box, and click OK.

2.2.11 Self-Test on Network

Response to the self-test on a network will either be with Normal... or with the Error Code. All available network diagnostic counters and information will be reset. If a Printer device is configured, addition information will be printed.

*Modbus Note: During self-test, communication alarms may trip, but these alarms will be reset after exiting program mode.*
2.2.12 List All the Nodes in Communications Failure

This diagnostic report feature allows you to determine the number of communication errors (communication alarms that occurred during scanning). A node will be in communication error if any of the node's channels are in error.
2.2.13 Diagnostic Codes Translation List

<table>
<thead>
<tr>
<th>CODE</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>no error condition detected</td>
</tr>
<tr>
<td>1</td>
<td>no key press</td>
</tr>
<tr>
<td>2</td>
<td>command parsing successful</td>
</tr>
<tr>
<td>3</td>
<td>tapp for transaction hasn’t expired yet</td>
</tr>
<tr>
<td>4</td>
<td>successful poll, no value in response</td>
</tr>
<tr>
<td>5</td>
<td>net scan turned off</td>
</tr>
<tr>
<td>10</td>
<td>unable to parse command entered</td>
</tr>
<tr>
<td>11</td>
<td>parameter value invalid</td>
</tr>
<tr>
<td>12</td>
<td>Data value too large or small</td>
</tr>
<tr>
<td>13</td>
<td>undefined path</td>
</tr>
<tr>
<td>14</td>
<td>SEQ out of GD:: range</td>
</tr>
<tr>
<td>15</td>
<td>string too long</td>
</tr>
<tr>
<td>16</td>
<td>PIN not unique</td>
</tr>
<tr>
<td>17</td>
<td>no empty or matching PIN slot</td>
</tr>
<tr>
<td>18</td>
<td>command does not apply to this type of object</td>
</tr>
<tr>
<td>19</td>
<td>Data value invalid per OI spec</td>
</tr>
<tr>
<td>30</td>
<td>default value requested via operator interaction</td>
</tr>
<tr>
<td>31</td>
<td>operator PIN privilege prevents operation</td>
</tr>
<tr>
<td>32</td>
<td>in read-only program mode -- can't alter value</td>
</tr>
<tr>
<td>33</td>
<td>command needs logging destination configuration</td>
</tr>
<tr>
<td>34</td>
<td>data lost while recording speech message</td>
</tr>
<tr>
<td>35</td>
<td>FAX session prevented by FCC requirement for RTU phone number</td>
</tr>
<tr>
<td>40</td>
<td>device open for read operations only</td>
</tr>
<tr>
<td>41</td>
<td>device open for write operations only</td>
</tr>
<tr>
<td>42</td>
<td>write operation failed, no diagnostic</td>
</tr>
<tr>
<td>43</td>
<td>Data truncated to fit into buffer</td>
</tr>
<tr>
<td>44</td>
<td>no room in queue</td>
</tr>
<tr>
<td>45</td>
<td>unsupported device number</td>
</tr>
<tr>
<td>50</td>
<td>modem carrier has dropped</td>
</tr>
<tr>
<td>51</td>
<td>modem driver read is blocking on CPM event</td>
</tr>
</tbody>
</table>

command-line errors

command execution errors

generic DEV/NET errors
### File errors

<table>
<thead>
<tr>
<th>CODE</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>60</td>
<td>file device at end of file</td>
</tr>
<tr>
<td>61</td>
<td>No NVM space available for writing</td>
</tr>
<tr>
<td>62</td>
<td>No FILE object exists for specified PATH</td>
</tr>
<tr>
<td>63</td>
<td>specified PATH is NVROM only</td>
</tr>
<tr>
<td>64</td>
<td>No NVM space available for file creation</td>
</tr>
<tr>
<td>65</td>
<td>No file directory exists for PATH</td>
</tr>
<tr>
<td>66</td>
<td>requested NVD data not found</td>
</tr>
<tr>
<td>67</td>
<td>file opened with access == NONE or illegal</td>
</tr>
<tr>
<td>68</td>
<td>file already opened</td>
</tr>
<tr>
<td>69</td>
<td>No room in directory for additional file</td>
</tr>
</tbody>
</table>

### NVM driver errors

<table>
<thead>
<tr>
<th>CODE</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>72</td>
<td>operation failed, no diagnostic info available</td>
</tr>
<tr>
<td>73</td>
<td>command sequence error detected</td>
</tr>
<tr>
<td>74</td>
<td>Don’t have compatible driver for this device</td>
</tr>
<tr>
<td>75</td>
<td>one or more blocks were flagged as corrupt</td>
</tr>
<tr>
<td>76</td>
<td>VPP low detected</td>
</tr>
<tr>
<td>77</td>
<td>block locked</td>
</tr>
</tbody>
</table>

### Miscellaneous device errors

<table>
<thead>
<tr>
<th>CODE</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>80</td>
<td>NULL channel does not support request</td>
</tr>
<tr>
<td>81</td>
<td>NULL device does not support request</td>
</tr>
</tbody>
</table>

### Generic Destination errors

<table>
<thead>
<tr>
<th>CODE</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>90</td>
<td>Destination does not support TEXT messaging</td>
</tr>
<tr>
<td>91</td>
<td>Destination is offline</td>
</tr>
<tr>
<td>92</td>
<td>pending transaction completed</td>
</tr>
<tr>
<td>93</td>
<td>session needs user input (WINTEL only)</td>
</tr>
<tr>
<td>94</td>
<td>session setup in progress</td>
</tr>
<tr>
<td>95</td>
<td>requested operation failed</td>
</tr>
<tr>
<td>96</td>
<td>requested operation completed</td>
</tr>
<tr>
<td>97</td>
<td>Destination is busy with other operation</td>
</tr>
<tr>
<td>98</td>
<td>Destination does not support requested language</td>
</tr>
<tr>
<td>99</td>
<td>message removed per Destination filtering parameter</td>
</tr>
</tbody>
</table>

### CODE DESCRIPTION

<table>
<thead>
<tr>
<th>CODE</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;Abnormal&quot; reset codes</td>
<td></td>
</tr>
<tr>
<td>100</td>
<td>&lt;descriptive messages vary&gt;</td>
</tr>
<tr>
<td>101</td>
<td>&quot;device conflict on port %d&quot;</td>
</tr>
<tr>
<td>102</td>
<td>&quot;NVM Erase failure @0x%0X&quot;</td>
</tr>
<tr>
<td>103</td>
<td>&quot;CPU Privilege Violation&quot;</td>
</tr>
<tr>
<td></td>
<td>Message Description</td>
</tr>
<tr>
<td>---</td>
<td>-------------------------------------------------</td>
</tr>
<tr>
<td>104</td>
<td>&quot;too many NVM chips&quot;</td>
</tr>
<tr>
<td>105</td>
<td>&quot;unsupported NVM device&quot;</td>
</tr>
<tr>
<td>106</td>
<td>&quot;unsupported NVM destination address (0x%08X)&quot;</td>
</tr>
<tr>
<td>107</td>
<td>&quot;unsupported NVM source address&quot;</td>
</tr>
<tr>
<td>108</td>
<td>&quot;unsupported NVM function flag&quot;</td>
</tr>
<tr>
<td>109</td>
<td>&quot;out of memory&quot;</td>
</tr>
<tr>
<td>110</td>
<td>&quot;memory list linkage error&quot;</td>
</tr>
<tr>
<td>111</td>
<td>&quot;unknown serialization specifier&quot;</td>
</tr>
<tr>
<td>112</td>
<td>&quot;WDOG expiration&quot;</td>
</tr>
<tr>
<td>113</td>
<td>&quot;firmware download completed&quot;</td>
</tr>
<tr>
<td>114</td>
<td>&quot;total power loss&quot;</td>
</tr>
<tr>
<td>115</td>
<td>&quot;CPU bus error&quot;</td>
</tr>
<tr>
<td>116</td>
<td>&quot;CPU address error&quot;</td>
</tr>
<tr>
<td>117</td>
<td>&quot;total system cleanup requested&quot;</td>
</tr>
</tbody>
</table>
2.3 Maintenance and Testing

Regular testing is the main element of a maintenance program for ongoing Catalyst RTU reliability. These tests should include interrupting primary power to the RTU for at least 4 hours to verify the gel cell battery maintains RTU operation for that time period. You may wish to temporarily disconnect the phone line or temporarily turn off the power failure alarm to avoid nuisance calls during the test period. The LOBAT light on the Catalyst activates whenever the battery voltage falls below a certain level. If the battery is not fully charged (as following installation or following a power failure) the light will be activated. The LOBAT light does not necessarily warn of a battery wearing out. It should be considered a secondary indication of battery and charger activity.

The only periodic replacement item on this product is the Gel Cell Lead Acid battery. The life cycle of this battery is similar to that of an automobile battery, so it should be replaced every three years. (See 2.3.1 Battery Replacement in the Rest of the Story) Note that this kind of battery cannot be stored for more than a few months without charging or it will deteriorate.

Replacement batteries can be ordered from RACO or directly from the manufacturer as printed on the battery.

Another replacement item that is not periodic is the fuse. It is suggested that two fuses be stored with the Catalyst. Occasionally a fuse will blow in response to a substantial high voltage transient on the power line, resulting in a power failure alarm. This occurs more commonly with 120 VAC input power than with DC power sources. Usually replacing the fuse will restore normal operation with no further need for service. The type of fuse depends upon the input power configuration:

<table>
<thead>
<tr>
<th>Input Power</th>
<th>Fuse Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>120 VAC</td>
<td>Littelfuse 229.003 3 amp</td>
</tr>
<tr>
<td>12 VDC</td>
<td>Littelfuse 229.001 1 amp</td>
</tr>
<tr>
<td>24 VDC converter module</td>
<td>Bussman BK/GMC 700 ma</td>
</tr>
<tr>
<td>48 VDC converter module</td>
<td>Bussman BK/GMC 315 ma</td>
</tr>
<tr>
<td>125 VDC converter module</td>
<td>Bussman BK/GMC 200 ma</td>
</tr>
</tbody>
</table>
2.3.1 Battery Replacement

- The gel cell battery is much like a car battery. At the end of its life when called on to deliver power, it discharges very quickly without prior warning. The best protection is to replace the battery every 3 years regardless of any test results.
- The battery is a Power Sonic PS 640 or equivalent, 4 AH 6 volts.
- Batteries should be purchased near the time of intended installation, since they can deteriorate over time when stored.

You may order a replacement battery from RACO at the address below:

RACO Manufacturing and Engineering Co.
1400 62nd Street
Emeryville, CA 94608

or from: Power Sonic, Redwood City, CA, USA: (650) 364-5001
3.0 Customer Support

3.1 Before Calling Customer Support

Before consulting the RACO Customer Service Department, or your local RACO Representative for assistance, please have the following information available:

- Provide information on your RTU configuration and its symptoms. This includes the worksheets and the performance history of the RTU.
- Provide information on network operating parameters. This includes cabling specification, protocol, node addresses and equipment types, loading patterns, and usage by other applications.
- Addresses and properties of all data table locations of interest to the application.
- Ability, as required, to access the RTU itself and specific nodes, their ladder logic, program listings, or Alarmware™.

3.2 Phone Technical Support Procedures

Make sure you have the following information before you call:

- **Serial Number**: This number is found on the inside door of the RTU. If you are not at the RTU or would like to get a complete Factory Settings Report use Alarmware™. After Alarmware™ is connected to your Catalyst RTU for the first time, the serial number is recorded in the RTU information data. To view serial number with Alarmware™ click on the RTU name from the Select RTU dialog. Click on the Edit button. The serial and model numbers can be viewed from this Add/Edit RTU dialog.
- **Note the RTU's symptoms**: Exact speech pattern, content of the messages, whether it is making calls or not. The more specific and accurate you are in describing the symptoms, the quicker the Customer Support Department will be able to diagnose and troubleshoot your problem. In many cases, this will prevent returning the RTU to the factory unnecessarily.
- **Copy .NVM and Message.txt Files**: To help us find the source of your problem, it may become necessary to provide us a copy of the Catalyst's .NVM file located in the Aware\Data directory. You may also be asked to provide a copy of the message.txt file located in the Aware directory.

If you need phone support regarding Alarmware™, you will not need a serial number but you will need to provide a detailed description of the problem you are having.

3.3 Customer Technical Support

RACO's Customer Support staff is committed to supporting our customers. In today's world of rapidly evolving technological solutions to industrial control and monitoring needs, you need to have the assurance that there is more than just a manual behind the product. Whether you have questions about implementing a solution, or need help during startup, we are standing by to assist.
3.4 Service Requirements

In the event of equipment malfunction, our Company or an authorized agent should perform all repairs. It is the responsibility of users requiring service to report the need for service to our Company or to one of our authorized agents. Service can be obtained at:

3.5 Returning RACO Products to the Factory

RACO Manufacturing and Engineering Company
1400 62nd Street
Emeryville, CA 94608 USA

To avoid shipping damage, pack your RTU well!

- A factory-issued RMA (Returned Materials Authorization) must be obtained prior to shipment and marked prominently on the outside of the shipping package.
- To avoid extra charges, return any product or swapped parts (such as replacement circuit boards) to the factory at the address below:

Remember to:

- Put the return address on the package
- Include a packing slip
- Have the Serial and RMA numbers handy when you call in for tracking
3.6 Software Problem Report

If you encounter a problem with the Alarmware™ program, or would like to request enhancements to the existing application, please complete the Software Problem Report and return to RACO via U.S. Mail, Fax, or Email.

Please provide the following information:

<table>
<thead>
<tr>
<th><strong>Submitter Information</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Date</td>
</tr>
<tr>
<td>Company Name</td>
</tr>
<tr>
<td>Address</td>
</tr>
<tr>
<td>Phone Number</td>
</tr>
<tr>
<td>Contact Name</td>
</tr>
<tr>
<td>Email Address</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Problem Report</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Short Description of Problem Description</td>
</tr>
<tr>
<td>Give a short and concise description of the problem you found.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Description</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Give a complete description of the problem (or enhancement request). Include all relevant information.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Steps to Reproduce</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Effect</td>
</tr>
<tr>
<td>Try to include the exact steps performed that lead to the reported problem.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Effect</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Explain effect of problem. For example, did the program cause an invalid page fault within Windows, or did the unit firmware crash? Is the problem aesthetic, or is it an enhancement request? Please include any relevant type of information regarding effect.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Factory Settings and Configuration Report</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Log File</td>
</tr>
<tr>
<td>Please include a copy of your Factory Settings and Configuration Reports. These reports include important information for reproducing reported problem. If it is possible to send the .NVM files via email, then the determining the problem and reproducing the problem become that much easier.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Log File</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>If the Log File information is useful, please include a Log File in the problem report.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Reproducible?</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Comments</td>
</tr>
<tr>
<td>Did the problem occur more than once? Can the problem be easily reproduced?</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Comments</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>This field is used for any other relevant information.</td>
</tr>
</tbody>
</table>
3.7 FCC Notice to Users

FCC Requirements

1. The Federal Communications Commission (FCC) has established Rules that permit this device to be directly connected to the telephone network. Standardized jacks are used for these connections. This equipment should not be used on party lines or coin phones.

2. If this device is malfunctioning, it may also be causing harm to the telephone network; this device should be disconnected until the source of the problem can be determined and until repair has been made. If this is not done, the Telephone Company may temporarily disconnect service.

3. The Telephone Company may make changes in its technical operations and procedures; if such changes affect the compatibility or use of this device, the Telephone Company is required to give adequate notice of the changes. You will be advised of your right to file a complaint with the FCC.

4. If the telephone company requests information on what equipment is connected to their lines, inform them of:
   
   (a) The telephone number to which this unit is connected.
   (b) The ringer equivalence number 0.8B
   (c) The USOC jack required. [RJ11C]
   (d) The FCC Registration Number: EMRUSA-42010-AL-E

Items (b) and (d) are indicated on the label. The Ringer Equivalence Number (REN) is used to determine how many devices can be connected to your telephone line. In most areas, the sum of the REN's of all devices on any one line should not exceed five (5.0). If too many devices are attached, they may not ring properly.
4.0 Floobydust

(A Mixed bag of items which are not necessarily related)

4.1 Adjusting Catalyst's Internal Speaker Volume

- The loudness of the front panel speaker can be adjusted via the small square variable resistor (trimpot) on the main circuit board. This trimpot is marked SPKR and requires a small, flat blade screwdriver to make the adjustment.
- This setting also controls the volume delivered to jack J1, marked SPEAKER OUT, which may be used to drive external speakers, or other audio devices.
- This trimpot cannot be used to turn the speaker sound off completely. If you wish to silence the speaker completely, use the Alarmware™ configuration setting (Configuration | Devices | Phone Config) provided for that purpose.

4.2 External Speaker Connections

- An audio output suitable for driving an external speaker of 4 to 16 ohms impedance, headphones, or other audio system, is available via the jack J1, marked SPEAKER OUT, located in the upper right hand area of the main circuit board.
- This jack is designed to accommodate an RCA-type phono plug. The tip end will be the audio signal, and the shell will be the ground.
- The output signal has a nominal impedance of 8 ohms and a nominal average amplitude of 1 volt RMS, when the speaker volume trimpot marked SPKR is set to full clockwise position.

4.3 PLC Watch-Dogging of RTU

The Catalyst RTU has its own internal watch-dogging intended to provide the strongest possible guarantee of mission readiness.

It is possible to add an additional level of system self-checking by using a PLC to monitor the health of the RTU. The strategy involves using the RTU's DNA capability to provide the PLC with a "heartbeat" indication that the RTU scan is active. When this heartbeat is not seen for a specified period of time, the PLC knows that the RTU is not scanning the PLC.

An example ladder logic implementing this strategy is described below. Please note that this strategy only provides an indication that the RTU scan is active. It will not detect failures involving other RTU subsystems, such as a severed speaker wire. Furthermore, indication failure does not necessarily imply that the RTU itself has failed (the RTU scan could be turned off, the PLC cable disconnected, etc).
Required PLC configuration: Uses 1 timer, 1 output relay, 1 discrete and 1 16-bit register.

<table>
<thead>
<tr>
<th>EXAMPLE</th>
<th>SYMBOL</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>00010</td>
<td>RTU_HEART</td>
<td>When set to '1' by RTU, failure timer is reset</td>
</tr>
<tr>
<td>40001</td>
<td>RTU_ACCUM</td>
<td>Accumulator for RTU failure timer</td>
</tr>
<tr>
<td>#0400</td>
<td>RTU_PRESET</td>
<td>400 second trip delay for RTU failure timer</td>
</tr>
<tr>
<td>00001</td>
<td>RTU_FAILED</td>
<td>Output relay for RTU failure indication</td>
</tr>
</tbody>
</table>

Required RTU Configuration: Uses 1 physical input and 1 channel.

1) Select one of the RTU's physical inputs and call it RTU1. Leave this input ungrounded so it will always have the logical value 1.

2) Configure any channel of the RTU as follows:
   (a) SNA = 0*1*RTU1
   (b) DNA = 1*1*RTU_HEART (assuming PLC is node 1)

4.5 Integrating the Catalyst and Analog Cellularm

The Catalyst defaults are designed for ordinary telephone line connections. When using the Cellularm there are certain delays that are inherent to cellular connections. The incoming and outgoing sessions will take longer to make connection to selected destination types. These delays will need to be extended.

There are also ways to optimize the performance of data and fax transmissions over a cellular phone network. This is accomplished by the use of modem initialization commands.
4.5.1 Setting Session Delays

The Catalyst has three delays that will need to be changed in order to make incoming and outgoing Cellularm connections:

1. Outgoing Call Answer Limit
2. Call-In Timer
3. Protocol Detection for Incoming Calls Timer

In order to change the length of these timers, you must either connect with Alarmware™, or make the changes from the front panel using keycodes.
To make the necessary changes using Alarmware™, connect to the unit and go to the "Configuration Menu." From the Configuration Menu, select "Devices." The following dialog will appear:

**Device Settings**

- **RTU Modem**
- **Printer**
- **Log**
- **Phone Config**
- **Physical Inputs**
- **Modbus Port**
- **Alarmware Port**
- **RTU Phone Number:** 1-510-594-4236
- **Call Progress Monitoring Enable:** checked
- **Outgoing Call Answer Limit:** 60 seconds
- **Speaker Enable:** checked
- **Country:** USA
- **Dialing Mode:** Tone
- **Ring Answer Delay:** 1 rings
- **After answering, wait a minimum of:** 60 seconds for the session to start

You will need to increase the "Outgoing Call Answer Limit" to at least 60 seconds. Some cellular networks will require more.

The Call-In Timer is seen here as "After answering, wait a minimum of 60 seconds for the session to start." This delay can be increased to 75 seconds.

In both cases, you will want to test these timers to determine if the proper timing is achieved.

To change the "Protocol Detection Timer" you will need to select "Session Params" from the Configuration Menu:

**Session Parameters**

- **Radial Attempts:** 1 attempts
- **Session Timeout:** 120 seconds
- **Reporting Priority Based Upon:** Destinations
- **InterSession Delay:** 0.5 minutes

**Microphone Listening Period at End of Session:**
- **Off**
- **During voice sessions, give the menu prompt no more than:** 1 times
- **When starting a data session, wait no more than:** 20 seconds to determine the protocol

Extend the "Protocol Detection for Incoming Calls Timer" to 20 seconds. That should be adequate to ensure there is enough time for the Catalyst to determine the type of protocol to be used in the current session.
4.5.2 Using Keycodes from the Front Panel

To extend the Outgoing Call Timer to 60 seconds, use **403*60**
To extend the Call-In Timer to 75 seconds, use **406*75**
To extend the Protocol Detection Timer to 20 seconds, use **827*20**

4.5.3 Optimizing Data and Fax Transmission

You should also configure the Catalyst modem to optimize performance. To insert a modem initialization command into the Catalyst, select "Devices" from the Configuration Menu and click on the RTU Modem tab:

![Device Settings](image)

We also recommend that you enter the same command for the *Alarmware™* modem. To access the *Alarmware™* modem settings, you should start *Alarmware™* and then "Cancel" the "Select RTU" dialog box. You will then have access to the "Options Menu." From the Options menu, select "Modem."
When connecting with a **Remote Data Terminal** you will need to add the modem commands to the Windows modem configuration:

1. First launch the Windows Control Panel.
2. From the Control Panel, select "Modems."
3. Select the proper modem from the list of available modems.
4. Click on "Properties."
5. Next click on the "Connection" tab.
6. Next click on the "Advanced" button.
7. Enter the Modem Initialization Commands as shown.

### Advanced Connection Settings

- **Use error control**
  - Required to connect
  - Compress data
  - Use cellular protocol
- **Use flow control**
  - Hardware (RTS/CTS)
  - Software (XON/XOFF)

**Modulation type**

- Standard

**Extra settings**

- &F1+MS=9,0,4800,4800

The Modem Initialization Commands are entered in the "Extra Settings" field as shown here…

- Configure the "Initialization String" as before with the same commands: &F1+MS=9,0,4800,4800
- It also helps to set the "Baud Rate" to 4800 to match the initialization string.
- Extend the "Outgoing Call Answer Limit" as shown.
4.6 Integrating the Catalyst and a Digital Cellularm System

Most digital cellular phones cannot transmit or receive data via the RJ11 phone jack. The only exception among the Telular product group that we use is the Phonecell SX5e GSM 850/1900. Therefore, when using a Catalyst coupled with a Cellularm, this is the phone to select. There are, however, a number of configuration issues to deal with both on the phone and on the Catalyst.

First, let’s deal with the phone. When setting up service, the user should specify a SIM chip that has CSD (circuit switched data). This will result in a service with a voice only phone number plus a second, data only, phone number, and perhaps a third number for analog FAX as well.

The voice number is dialed when placing voice calls to the Catalyst. The Catalyst uses this line for placing outgoing calls to voice, numeric or alpha numeric pager destinations. If these are the only destination types you use, you can get by with just the 1 voice number.

The data number is dialed when placing Alarmware or Remote Data Terminal calls to the Catalyst. The Catalyst uses this line for placing outgoing calls to Email and Remote Data Terminal destinations. If you are not using Alarmware or RDT destinations, you do not need the second data line.

The analog fax number does not support incoming fax report requests. (These dial-in, or “polling” requests can be done using a land line). The Catalyst does require the fax number for placing outgoing calls to Fax destinations. If you are not using Fax destinations you do not need the analog fax line.

After the SIM chip has been installed, and service has been activated, the Phonecell must be configured as follows. If the Phonecell was originally shipped with your Catalyst RTU, steps 1-7 below have already been performed at the factory.

1. Connect the Catalyst or a telephone handset to the Phonecell’s RJ11 jack designated with the telephone icon.

2. Press the “dial out” button on the Catalyst, or take the handset off hook. You should hear dial tone.

3. Quickly enter #*114*4#. This sets the data modulation to a Baud Rate of 9600.

4. You should now hear dial tone. Hang up by pressing the normal key. If you heard any other strange tones, you will need to reenter the code.

5. Go off hook again and quickly enter #*115*0*7#. This sets the Air Interface Data Rate to a Baud Rate of 9600 and Error Correction to on.

6. Hang up when dial tone is heard again. Retry if any other tones are heard. You must hang up between each code string entry.

7. Finally, enter #*113*1*0#. This sets the RJ11 jack for data mode and sets carrier timing delays to the default values.
Now, it is necessary to configure the Catalyst to operate correctly with the Phonecell device. This involves the following steps:

8. Set the “GSM digital cell phone” configuration item to “ON”. This may be done by entering keycode 409*0 from the front panel or over the phone in program mode. Or, use the Device->Phone Configuration page in Alarmware.

9. If you are not using Alarmware or any data or fax mode destinations you may skip the remaining steps.

10. The RTU phone number as shown and used by Alarmware must be set to the Phonecell’s data number. Do this using keycode 409 *<phone number>, or from the Device->Phone Configuration page in Alarmware.
11. Add the appropriate “bypass string” to the start of each telephone number for each destination. This string commands the Phonecell to use a particular phone line while dialing out. The bypass strings are listed in table below.

12. Edit the destination’s “call back number” as desired, using Alarmwares Config->Destination->Advanced page tab. This is useful since the default number is the data number, but personnel will most likely be calling the unit back using voice mode. The third column in table below indicates if this feature is supported for the destination type.
13. The Catalyst’s “Protocol Detection Time Limit” must be greater than 20 seconds. You may need to try different values to find the most successful connection rate.

14. Note that anytime the “Dial Out” key is pressed for originating a call in speaker phone mode, the bypass string #*19*0# will need to be dialed first.

<table>
<thead>
<tr>
<th>Destination Type</th>
<th>Bypass String</th>
<th>Edit Call Back Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Telephone/Voice</td>
<td>#<em>19</em>0#, No</td>
<td></td>
</tr>
<tr>
<td>Numeric/Beeping Pager</td>
<td>#<em>19</em>0#, Yes</td>
<td></td>
</tr>
<tr>
<td>AlphaNumeric Pager</td>
<td>#<em>19</em>0#, Yes</td>
<td></td>
</tr>
<tr>
<td>Fax Machine</td>
<td>#<em>19</em>1#, No</td>
<td></td>
</tr>
<tr>
<td>Remote Data Terminal</td>
<td>#<em>19</em>2#, Technically, the bypass string is not required, but can be included for consistency</td>
<td>No</td>
</tr>
<tr>
<td>PA System</td>
<td>None required</td>
<td>No</td>
</tr>
<tr>
<td>Email Recipient</td>
<td>Not Available</td>
<td>Yes</td>
</tr>
</tbody>
</table>

4.6.1 Limitations when using the Catalyst and a Digital Cellular System

- Incoming Polling Calls for the FAX are not supported
- Incoming Polling Calls for Remote Data Terminals when PINs are required for the session to start are not supported
- Data transfer rate is limited to 9600 baud
- The success rate for report completion is reduced when the size of the report is increased. It is important to keep the size of the report under 50 Kbytes. Reports over this size will typically fail at some point during the transfer.
- Data sent to Remote Data Terminals will include some garbage characters at the end of the report. These characters are induced by the cell network and can corrupt the Remote Data Terminal port, preventing further connections without rebooting your computer. To avoid these problems, it is suggested that you use LOGTRAN for transferring Log File information. Log file size limitations still apply however.
During "Over the Phone" programming, some spurious DTMF tones might be heard. These tones are induced by the network, but should have no effect on the programming of the Catalyst. It is recommended that during OTP programming, you enter the keycodes at a slower pace than you would normally. This is to ensure that the keycode entered is completely relayed to the Catalyst due to the time lag over the cell network.

4.7 Interfacing the Catalyst and the Automation Direct Terminator I/O

The Catalyst is very well suited to be interfaced to the Automation Direct Terminator I/O (T1K) distributed I/O product. However, there are a few changes that need to be made from the default configuration of each product.

Please Note: This document will refer to certain pages of the T1K User Manual, so please have the manual available when you are ready to make settings changes.

4.7.1 Setting the Catalyst Modbus Port Parameter

The Catalyst Modbus Port is configured for "Even" Parity by default. In order to communicate with the T1K, you will need to change the Parity setting to "Odd."

To make the necessary change using Alarmware™, connect to the unit and go to the "Configuration Menu." From the Configuration Menu, select "Devices." Click on the "Modbus Port" tab. The following dialog will appear:

![Device Settings Dialog](image)

You will need to change the parity from "Even" to "Odd."

Notes:
1. The baud rate must correspond to the setting at the DIP switch SW1 on the side of the T1K Modbus Interface Module.
2. The Node Address must correspond to the node setting on the T1K Modbus Interface Module.
4.7.2 Terminator I/O Base Controller Settings

Most of the Terminator I/O Base Controller settings will be left in their default settings, with the following exceptions:

- You will need to set the T1K baud rate to 9600 baud. Refer to pages 2-4 of the "T1K Modbus Base Controller User Manual." You will be instructed on how to change the SW1-SW3 DIP switches to achieve 9600 baud.
- Set the "Node Number" switches to the desired Node. Refer to pages 2-7 of the "T1K Modbus Base Controller User Manual." The default node address for the Catalyst is 1.

4.7.3 Modbus Address Mapping

Please refer to pages 3-4 of the "T1K Modbus Base Controller User Manual" for the technical details of the T1K Modbus 584/984 addressing.

<table>
<thead>
<tr>
<th>Discrete Inputs</th>
<th>Starting Address</th>
<th>10001</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number of Addresses</td>
<td>1024</td>
</tr>
<tr>
<td>Catalyst SNAs* (Node 1)</td>
<td>1<em>1</em>10001 through 1<em>1</em>11024</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Discrete Outputs (Coils)</th>
<th>Starting Address</th>
<th>00001</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number of Addresses</td>
<td>1024</td>
</tr>
<tr>
<td>Catalyst SNAs* (Node 1)</td>
<td>1<em>1</em>00001 through 1<em>1</em>01024</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Analog Inputs</th>
<th>Starting Address</th>
<th>30001</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number of Addresses</td>
<td>64</td>
</tr>
<tr>
<td></td>
<td>Number of Channels</td>
<td>32</td>
</tr>
<tr>
<td>Catalyst SNAs* (Node 1)</td>
<td>1<em>1</em>30001 through 1<em>1</em>30064</td>
<td></td>
</tr>
</tbody>
</table>

**Special Note:** Analog points occupy 2 consecutive 16-bit integers, but the second of the two are not used. Therefore, the first analog point address is 30001. The second is 30003. The third is 30005, and so on.

<table>
<thead>
<tr>
<th>Analog Outputs</th>
<th>Starting Address</th>
<th>40001</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number of Addresses</td>
<td>64</td>
</tr>
<tr>
<td></td>
<td>Number of Channels</td>
<td>32</td>
</tr>
<tr>
<td>Catalyst SNAs* (Node 1)</td>
<td>1<em>1</em>40001 through 1<em>1</em>40064</td>
<td></td>
</tr>
</tbody>
</table>

* SNA refers to "Source Net Address" for the Catalyst Channel Setting.

4.7.4 Catalyst Scaling for Terminator I/O Analog Channels

The resolution of Terminator I/O analog points is 14 bits (13 bits plus the sign bit) for inputs, and 12 bits for analog outputs.
<table>
<thead>
<tr>
<th>Available Voltage Spans</th>
<th>Available Current Spans</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-5V</td>
<td>0-20mA</td>
</tr>
<tr>
<td>0-10V</td>
<td>4-20mA</td>
</tr>
<tr>
<td>+/- 5V</td>
<td>-20 to +20mA</td>
</tr>
<tr>
<td>+/- 10V</td>
<td></td>
</tr>
</tbody>
</table>

Please Note:

1. As observed in the table above, Automation Direct analog modules allow both positive and negative (bipolar) inputs and outputs. However, the Catalyst cannot monitor negative currents or voltages. For signals monitored by the Catalyst that swing both positive and negative, while the signal is negative the Catalyst will report erroneous readings.

2. For Voltage inputs, the T1K product does not provide a way to set the gain of the inputs. Therefore regardless of the desired input voltage span, the resolution is always the same, 1 count in 8192 (or 1.22mV) for inputs and 1 count in 2048 for outputs (or 4.88mV).

4.8 Catalyst LED Patterns

The following describes the various LED patterns seen on the Catalyst front panel and their indications:

**All LEDs ON:** This is the first LED pattern seen when the RTU boots. It indicates that IRQs are enabled, SPI bus initialized, and the firmware is scanning the NVM space for a newly downloaded firmware image.

![LED Pattern](image)

**Checkerboard:** This is animation pattern shown below. It is the second pattern shown when the product boots.

![Checkerboard Pattern](image)

*It persists however long it takes to either:*

a) Install the new firmware image found earlier (if any). When that installation complete (or failed for whatever reason), then the “all LEDs on” pattern is briefly displayed before continuing to b).

b) Perform all devices, file system, and task initializations. If the file system fails any integrity tests (as will happen after any firmware download), a reformat operation will occur. See the “NVRAM Format” pattern description below. The checkerboard will resume when formatting complete.

**All LEDs OFF:** When seen briefly after the checkerboard during boot, then all tasks have been initialized and normal operations with the usual indications have begun. When seen after power off button pressed, the RTU has successfully saved current state information and powered down.
Usual Indications: Each LED shows a specific RTU or channel state as indicated by the LED legend and described in section xxx of the Catalyst Operator’s Manual. When this pattern is seen after the checkerboard, the RTU has booted successfully and is available for all normal box activities.

Firmware Download: This animated pattern consists of a single lighted column moving sequentially from left to right. It is seen while the RTU is busy with Alarmware downloading new firmware and hence unavailable for all other normal box activities.

NVRAM Format: This is a funny animated pattern sampled below. The CHECK led (farthest left) is constantly on. LEDs to the right indicate which NVM block number is currently being formatted. The rows form a two’s complements of the binary representation of that block number. As each block is processed, the pattern will slowly count up.

- When seen, the RTU is reformating the entire NVRAM file system and hence unavailable for normal activities until the operation is complete. Then all configuration information will have returned to factory defaults.
- This pattern will be seen during RTU boot only if file system corruption is detected, a new firmware installation was successful or a firmware download attempt failed. It is seen during normal RTU operations only when specific programming commands request file system cleardown.
- Hardware problems may cause this pattern to freeze or repeatedly restart after reaching a certain block number.
# Index

<table>
<thead>
<tr>
<th>Topic</th>
<th>Pages</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACKNOWLEDGMENT</td>
<td>34, 36</td>
</tr>
<tr>
<td>Active Nodes</td>
<td>3</td>
</tr>
<tr>
<td>Adjusting Internal Speaker Volume</td>
<td>26</td>
</tr>
<tr>
<td>Alarm Report</td>
<td>3, 38</td>
</tr>
<tr>
<td>ALARM VIOLATION CRITERIA</td>
<td>4</td>
</tr>
<tr>
<td>aliasing</td>
<td>4</td>
</tr>
<tr>
<td>Automation Direct Terminator I/O.</td>
<td>48</td>
</tr>
<tr>
<td>Battery Replacement</td>
<td>33</td>
</tr>
<tr>
<td>Before Calling Customer Support</td>
<td>34</td>
</tr>
<tr>
<td>bypass string</td>
<td>46, 47</td>
</tr>
<tr>
<td>call back number</td>
<td></td>
</tr>
<tr>
<td>Cellulararm</td>
<td>39, 40, 44, 47</td>
</tr>
<tr>
<td>Configuration Planning Utility</td>
<td>39, 44, 50</td>
</tr>
<tr>
<td>Configuration Utility Example Worksheets</td>
<td>39, 44, 50</td>
</tr>
<tr>
<td>contacted</td>
<td>6</td>
</tr>
<tr>
<td>CSD (circuit switched data)</td>
<td>44</td>
</tr>
<tr>
<td>Customer Support</td>
<td>34</td>
</tr>
<tr>
<td>Customer Support Before Calling</td>
<td>34</td>
</tr>
<tr>
<td>Diagnostic Codes List</td>
<td>21</td>
</tr>
<tr>
<td>Diagnostic Codes Translation List</td>
<td>29</td>
</tr>
<tr>
<td>Diagnostic Reports</td>
<td>27</td>
</tr>
<tr>
<td>Diagnostics, All</td>
<td>27, 28</td>
</tr>
<tr>
<td>digital cellular phones</td>
<td>44</td>
</tr>
<tr>
<td>Error Codes</td>
<td>22</td>
</tr>
<tr>
<td>External Speaker Connections</td>
<td>38</td>
</tr>
<tr>
<td>FCC Notice to Users</td>
<td>37</td>
</tr>
<tr>
<td>Glossary</td>
<td>3</td>
</tr>
<tr>
<td>GSM digital cell phone</td>
<td>45</td>
</tr>
<tr>
<td>Intersession Delay</td>
<td>8</td>
</tr>
<tr>
<td>Maintenance and Testing</td>
<td>32</td>
</tr>
<tr>
<td>Modbus Address Mapping</td>
<td>49</td>
</tr>
<tr>
<td>modem initialization</td>
<td>39, 42</td>
</tr>
<tr>
<td>Network Diagnostic Capabilities</td>
<td>26</td>
</tr>
<tr>
<td>NVM</td>
<td>30, 31, 34</td>
</tr>
<tr>
<td>Phone Technical Support Procedures</td>
<td>34</td>
</tr>
<tr>
<td>Phonecell</td>
<td>44, 45, 46</td>
</tr>
<tr>
<td>PIO</td>
<td>10</td>
</tr>
<tr>
<td>polling</td>
<td>11, 44</td>
</tr>
<tr>
<td>Preventive Maintenance &amp; Testing</td>
<td>32</td>
</tr>
<tr>
<td>Protocol Detection Time Limit</td>
<td>47</td>
</tr>
<tr>
<td>Protocol Detection Timer</td>
<td>41, 42</td>
</tr>
<tr>
<td>Return Error Codes</td>
<td>29</td>
</tr>
<tr>
<td>Returning Raco Products to the Factory</td>
<td>35</td>
</tr>
<tr>
<td>RMA</td>
<td>35</td>
</tr>
<tr>
<td>SCADA</td>
<td>6, 12</td>
</tr>
<tr>
<td>Self-Test</td>
<td>23, 26, 27</td>
</tr>
<tr>
<td>Software Problem Report</td>
<td>36</td>
</tr>
<tr>
<td>T1K</td>
<td>48, 49, 50</td>
</tr>
</tbody>
</table>
Index

Technical Support Procedures ................................................................. 34
Telular ................................................................................................. 44
Testing & Maintenance ........................................................................ 32
watch-dogging .................................................................................... 38