GE Consumer & Industrial
Multilin

Quick Start Guide

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GE Transponder

Chapter 1: Introduction

1.1 Transponder

The Transponder is the central data collector for the GE metering system. The communication system uses the existing electric wires in a building to connect with each tenant or customer. The Transponder uses twoway PLC (Power Line Communications) to transmit and receive the data over the power lines and can be read remotely using a telephone modem, Ethernet connection or via other communication systems. The device can also communicate via a direct connection using a computer and optical probe. The Transponder is used to collect data blocks from each meter on the system on a daily basis. The Transponder does not remove data, but instead it retrieves a copy of the data that exists in the meter. This redundant data storage provides security and system flexibility. Up to 240 metering points can be routed to the Transponder, collecting and concentrating data blocks from each meter on the system. The data blocks contain all previously uncollected meter readings, interval readings and event logs. The data is then appended to the file and stored in non-volatile flash memory for an average of about forty days.

The Transponder utilizes flash memory which enables reliable data storage and integrity without battery reliance. In addition to metering data, it stores a comprehensive list of the relevant metering events. The recorded events include: power consumption, demand resets, power ups and power downs, time changes, and tampers.

1.2 Transponder Assembly

The Transponder includes the parts listed below (See Figure 1-2.). These parts can be purchased individually in the event that a part of a Transponder has been damaged.

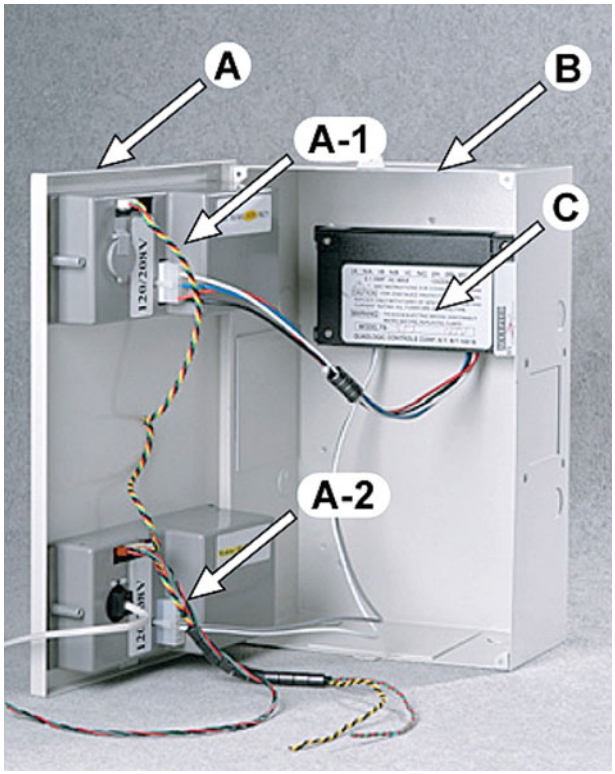

FIGURE 1–1: Transponder parts.

A. Transponder Head

A-1. Transponder Module

A-2. Communications Module

B. Back Box

C. Fuse Block

1.3 Specifications

MONITORING SPECIFICATIONS
Voltage: 120/240V, 220/380V, 277/480V, 347/600V
Frequency: .....10 – 90 kHz
Number of Metering Points per Scan Transponder: Up to 240

COMMUNICATIONS OPTIONS
Via Power Line Communications, the Transponder collects metering data for up to 240 metering points. Data retrieval from the Transponder (for highrise applications) is typically achieved by remotely connecting through a standard 19.2k Modem/RS232 which is internal to the Transponder.
The data from the Transponder can be taken directly through the use of the optical head which is available as a standard feature. An IEC Optical Communications Interface is needed to use with the optical head (optical probe is sold separately).
If more than one Transponder is required due to volume of meter points or the electrical distribution, several Transponder's can be networked together using the following options:

- Network Data Link (4-wire RS-485) (see appendix)
- Wireless Antenna

LIQUID CRYSTAL DISPLAY
32-digit liquid crystal display (16 digits x 2 rows)
6 whole digit consumption register
Data digit height: 0.31

OPERATING RANGE
Rated Voltage: .....90% to 110%
Temperature: .....-20°C to +60°C

MEMORY
4 Megabyte non-volatile flash memory retains daily and interval metering data (even during power outage).
During power outage, long-life lithium battery maintains time, logs incoming pulses and stores only the current interval data.

SHIPPING WEIGHT AND DIMENSIONS
1 Enclosure: .....13.5H x 8.5W x 4.5D
Shipping weight: .....1 Assembly: 11.5 lbs

ENVIRONMENT
Usage: .....For indoor use only
Enclosure: .....NEMA 1 rated
Temperature: .....-20°C to +60°C
Humidity: .....0-90% relative humidity (non-condensing)
Pollution Degree: 1
Maximum Altitude: .....2000 meters

METERING INDUSTRY STANDARDS
UL and CUL: .....Recognized under E204142

GE Transponder-5

Chapter 2: Installation

2.1 Installation Cautions And Warnings

- Do not install if the device is damaged. Inspect the box for obvious defects such as cracks in the housing.
- If the device is installed or used in a manner not specified by the accompanying documents, the safety of the device may be impaired.
- If the device functions abnormally, proceed with caution. The safety of the device may be impaired.
- Do not install the meter around combustible gas or gas vapor.
- Do not install the meter on an electrical service with current or voltage outside of the specified limit of the device.
- Do not operate the Transponder with the cover removed.
- To avoid electric shock, disconnect mains before replacing fuses.
- Beware of working around this Transponder when the voltage is live. There is a risk of electric shock.
- For protection against fire, replace only with fuses of the specified voltage and current rating.
- See instructions for connection diagrams.

2.2 Protective Conductor Terminal

Securely fasten one end of the earthing wire so that the screw cuts the paint on the back box. Securely fasten other end of the wire to true earth ground connection. When earthing to the electrical conduit, use continuous pipes, bending when necessary instead of using couplers.

2.3 Installation Guidelines For Transponders

GE's Transponder (Transponder) is the data collector and communications device for the metering system. The placement of Transponders is dependent on the number of services to the building, the number of metering points and the data storage requirements.

1. In order to determine the number of Transponders, first determine the number of utility "services." "Services" are defined as 120/208V, 277/480V, 480V, 347/600V and 600V utility transformer secondaries where the primary voltage is typically higher than 4kV. There should only be one step down transformer (i.e. from 480V to 120V) between the utility "service" and the GE meters.
2. Determine the number of tenant spaces fed from each "service" and determine which "service" feeds each meter point. This information is vital to proper system operation because with the GE system, "service" to tenant space determines the Transponder to GE meter relationship and is therefore critical for communications.
3. Determine the desired number of meter points you will require the Transponder to store metered data.
4. In cases of parallel utility transformer secondaries or unusual service entry designs, please consult factory for design assistance in Transponder placement.

Summary:

A Transponder is required:

1. For each "service" as defined above
2. For every 240 metering points
3. To meet certain data storage limitations

Installation Instructions For Transponders

The use of the following procedure is mandatory both for safety and Transponder certification purposes. Certification requires a visual inspection of the voltage taps on the incoming feeder phase wires and communication checks between the Transponder and the meters.

1. The Transponder requires a 3-phase 4-wire voltage connection to the "service" for Power Line Communications.
2. The best location for Transponder installation is the closest point to the GE meters before the main feeder for the "service" branches out into sub-feeders. This is the last point in the "service" before the first riser switch that feeds any GE meters (see Figure 2-1).

To find this point, follow the feeders from the secondary of the distribution transformer (or service entrance if the transformer is off the property) and place the Transponder at the last point before the feeder breaks into **multiple feeders.**
Typically, this will be in the main switchboard for the "service".

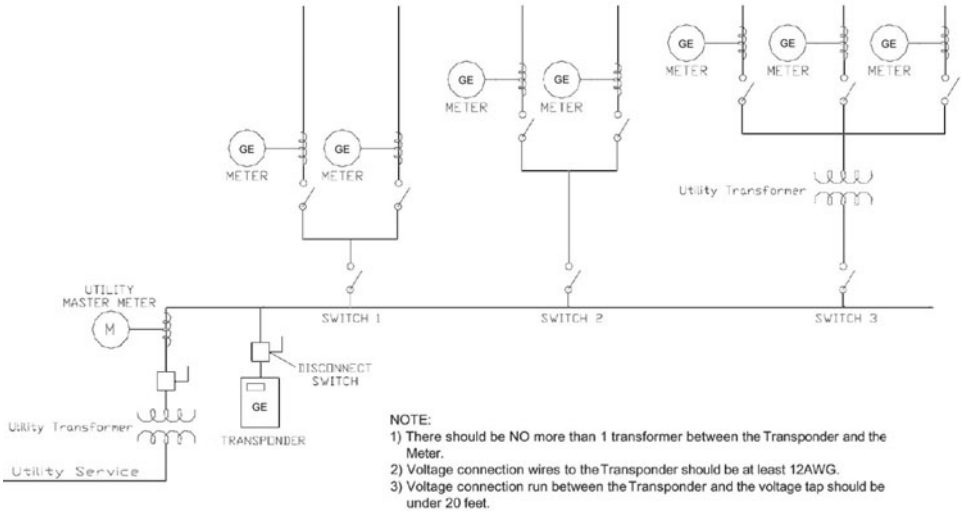

FIGURE 2–1: Typical Transponder Installation

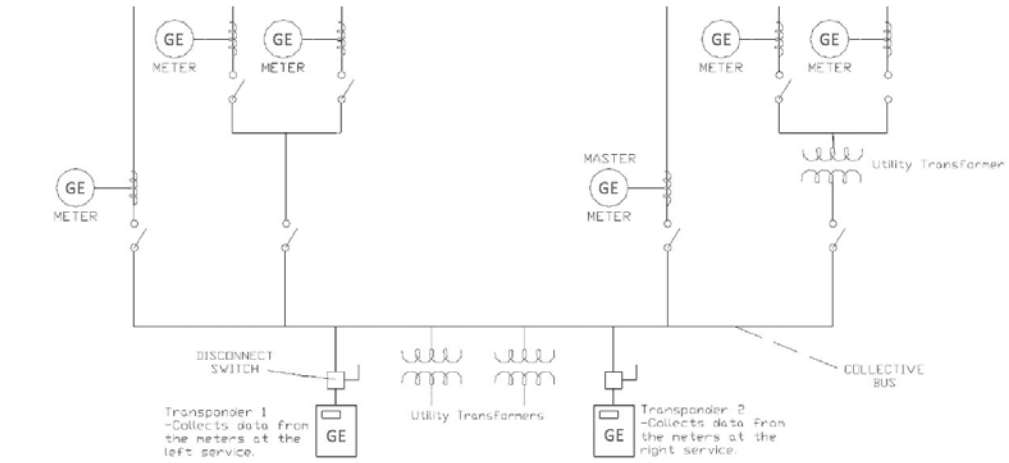

FIGURE 2–2: Non-standard "collective bus" Transponder Installation

The voltage connection should be connected by #12 AWG wire and a service disconnect switch is recommended (local codes apply). If the switch is fused, fast acting (not slow blow) fuses must be utilized.

3. The voltage wiring should be the shortest distance possible between the "service" tap and the Transponder as this is the signal injection path. If possible, use direct busway taps and keep runs under 20 feet.

4. The voltage connection must be 3 phase 4 wire and all voltage and neutral connections are from same “utility” service. .

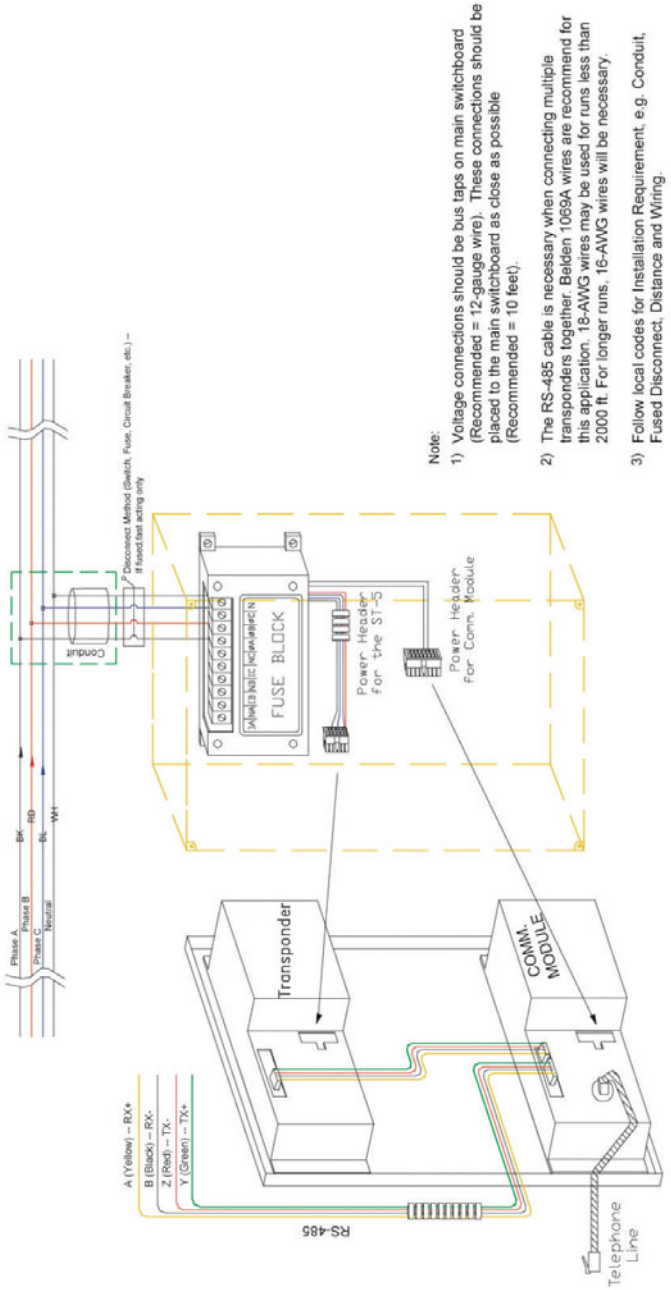

FIGURE 2–3: Transponder with Modem Installation Diagram

GE Transponder-5

Appendix

A.1 RS-485 Overview

GE devices may sometimes use a RS-485 interface to construct a multi-point communications network. The RS-485 interface is connected in a 4-wire full-duplex mode and is capable of handling 32 transmitters along with 32 receivers. In a four-wire network it is necessary that one node be a master node and all others be slaves. The network is connected so that the master node communicates to all slave nodes and all slave nodes communicate only with the master node.

A.2 Guidelines For Proper Wiring of a RS485 Network

A.2.1 Cable Selection[1]

Selecting data cable for a RS-485 system is important because intermittent communication problems are often caused by marginal cable and can be difficult to troubleshoot. The most important parameters that dictate the type of cable that will be used are Characteristic Impedance, Shunt Capacitance, and cable length or transmission run.

Characteristic Impedance (Ohms)

> "Characteristic Impedance is value based on the inherent conductance, resistance, capacitance and inductance of a cable that represents the impedance of an infinitely long cable. When the cable is cut to any length and terminated with this Characteristic Impedance, measurements of the cable will be identical to values obtained from the infinite length cable. That is to say that the termination of the cable with this impedance gives the cable the appearance of being infinite [in] length, allowing no reflections of the transmitted signal. If termination is required in a system, the termination impedance value should match the Characteristic Impedance of the cable."[1]

Shunt Capacitance (pF-ft)

> "The amount of equivalent capacitive load of the cable, typically listed in a per foot basis. One of the factors limiting total cable length is the capacitive load. Systems with long lengths benefit from using low capacitance cable."[1]

Cable Length (Transmission Run)

> Typical RS-485 systems have a maximum transmission run of 4000 feet. The total cable length (transmission run) will start from the first unit up to the last unit in the data link network.

The type of cable used for RS-485 is typically a twisted-pair wire which is simply a pair of wires with equal lengths that is twisted together. A twistedpair wire helps prevent radiated EMI and it also reduces the effects of received EMI. Because the two wires are close together and twisted, the noise received on one wire will tend to be the same as that received on the second wire. This type of noise is referred to as "common-mode noise." As RS-485 receivers are designed to look for signals that are the opposite of each other, they can easily reject noise that is common to both.

Recommended wires include Delco 43902, Belden 3087A, and Belden 9842.

A.2.2 Termination Resistors[2]

> "A terminating resistor is simply a resistor that is placed at the extreme end or ends of a cable. The value of the terminating resistor is ideally the same value as the characteristic impedance of the cable."[2]

1. http://www.arcelect.com/485info.htm
2. http://www.maxim-ic.com/appnotes.cfm/appnote_number/763

The value of the terminating resistor MUST match the characteristic impedance of the wire or else reflections will occur when the signal travels down the cable. There are instances where reflections are bound to happen because of cable and resistor tolerances; however, large enough mismatches may cause reflections big enough to bring about errors in the transmitted data.

With this in mind, it is important to match the terminating resistance and the characteristic impedance as closely as possible. The position of the terminating resistors is also very important. Termination resistors should always be placed at the far ends of the cable.

A.2.3 Datalink Network

GE meters and Transponders can be set-up to be a data link communication network when an RS-485 module is available (see Figure 3-1). The data link communication network can have up to thirty (30) meters which are daisy chained together. The beginning and end of each 30-meter segment within the network MUST have two (2) terminating resistors for each pair of wires.

The data link communication network most of the time will have a GE device with a Modem/RS-485 module where a dedicated telephone line will be plugged in. It is highly recommended to put the GE device with the Modem/RS-485 module at the beginning of the network. Furthermore, the total wire run of the network MUST not exceed the wire limit of 4,000 feet.

Occasionally, however, it becomes necessary for a particular meter to be further away from the “main RS-485 Data Link trunk” than the distance allowed by the supplied RS485 cable on the Transponder (see figure 2-3). In such an event, a longer, extended cable CANNOT be used to connect that meter to the RS-485 Data Link in an elongated “T” junction configuration. Rather, the RS-485 must be routed directly into that individual meter and then drawn back out from that meter to the next meter in the system in one continuous line.

While it would seem reasonable for a branch or “T” connection to run from RS-485 Data Link and permit the proper functioning of the data gathering, this is not a solution. It is absolutely imperative that a GE metering system with RS-485 Data Link never have branches running from the main line. The twisted, shielded pair wires must “enter” and “exit” each meter in the system with the exception of the first and last “terminator” meters.

A.2.4 RS-485 Data Link Installation Guidelines

If more than one Transponder is required due to volume of meter points or the electrical distribution, several Transponders can be networked together using interconnecting RS-485 line.

1. If there is more than one Transponder, install the other Transponders and the interconnecting RS-485 line, if required, which links all of the Transponders. See Figure A-1.
2. An RS-485 line is a pair of wires, AWG #20 or larger in diameter, which begins at one Transponder where a terminator is placed.
3. The RS-485 line runs from Transponder to Transponder ending at the final Transponder, where another terminator is placed.

4. It is critically important that there should never be three RS-485 pairs entering or leaving one Transponder box.
5. For the two Transponders which gave terminators, only one RS-485 pair leaves each box.
6. For the other Transponders, if there are more than two, exactly two RS-485 lines should leave the box: each line goes to another transponder in the daisy-chain. Only one modem should be installed in a data link system. If there are two or more modems in a data link system, the T5s will not communicate with each other.
7. There may be no more than 32 Transponders on a daisy-chain.
8. If possible, run the RS-485 lines in a conduit to protect them from damage. It is critically important to observe the polarity of the wires. The RS-485 data link uses a black and yellow color code. Match black to black and yellow to yellow; otherwise the data link will not work.
9. Avoid having loose conductors by using wire nuts to connect wires together. Use wire nuts suitable for the wires' gauge.
10. The data link should run no more than 4000 feet.
11. To Test the data link, measure the DC voltage across the yellow to black wire. This should measure between 0.1V and 0.3V. If it is negative or outside of that range, re-check all of the Transponder boxes according to the above specifications.

A.2.5 RS-485 Data Link Troubleshooting Guide

RS-485 network problems are often caused by cabling issues which may be difficult to troubleshoot. Complications include:

- Inability to login into a GE device.
- Intermittent or no communication to a GE device.
- Garbled characters appear on the terminal screen when logged into a GE device.

Listed below are guides that can help troubleshoot a faulty RS-485 network.

- Make sure the meter is energized.
- **Make sure that there is voltage coming into the fuseblock of the GE device**. It may also be necessary to check if the fuses in the fuseblock are not yet blown.
- **Make sure the voltage plug is connected properly to the meterhead** and communications module.
- **Make sure the 4-wire communications cable is connected to the communications module** and the GE meter or Transponder head.
- **Make sure there is black tape covering the optical port window on meter**.
- Make sure that recommended wires were used.
    - Must use 2 Pair (Dual Twisted ONLY) wire with 24 AWG or thicker. Shield is not necessary but if there is a shield, ground shield to metal housing at only of the ends of the network.
      Do not connect at the other end or at midpoints.
    - Recommended wires are Belden 9842, Belden 3087A or Delco 43902.

- Make sure the RS-485 wires are spliced together correctly.
    - Like colors from pigtails connect to the same circuit.
    - Make sure enough insulation is stripped off wire to make solid contact with the circuit.
    - Use wire nuts that are rated for the number of wires and gauge.
    - Avoid excess bare wire outside of the wire nut.
    - Make sure that the wires are not shorted together or to the box.
- Make sure there are no T branches in the RS-485 network.
    - Pigtails make a short wire connection to straight network.
    - Make sure there are no bare wires touching any metal conductors.
    - **Make sure data link is not more than 4000 feet with the meter at the end of the link**.
    - Make sure terminating resistors are in place.

If the problems persists after verification contact a GE technical support representative for further assistance. It is possible that the GE device is defective and may need replacement.

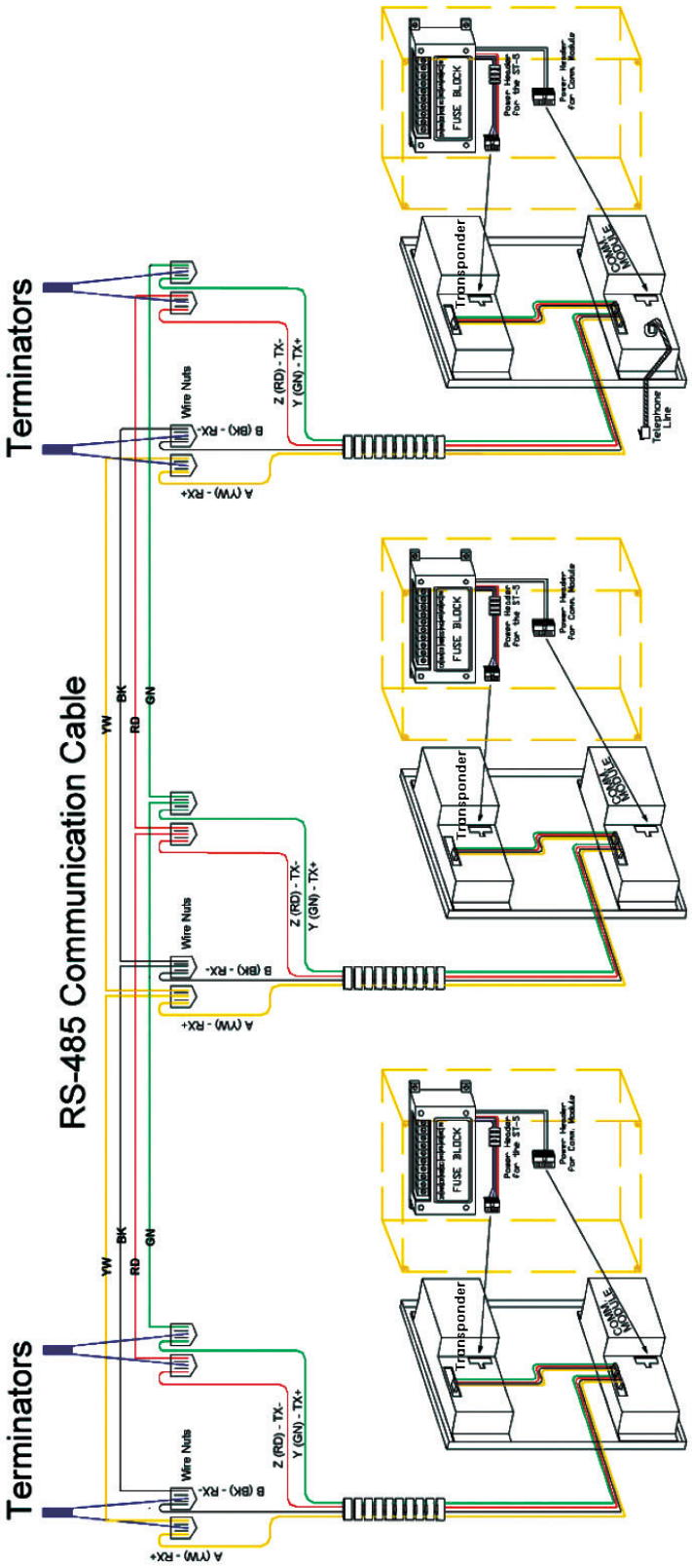

FIGURE A–1: Transponder Communication Network

A.2.6 Communications Installation Diagrams

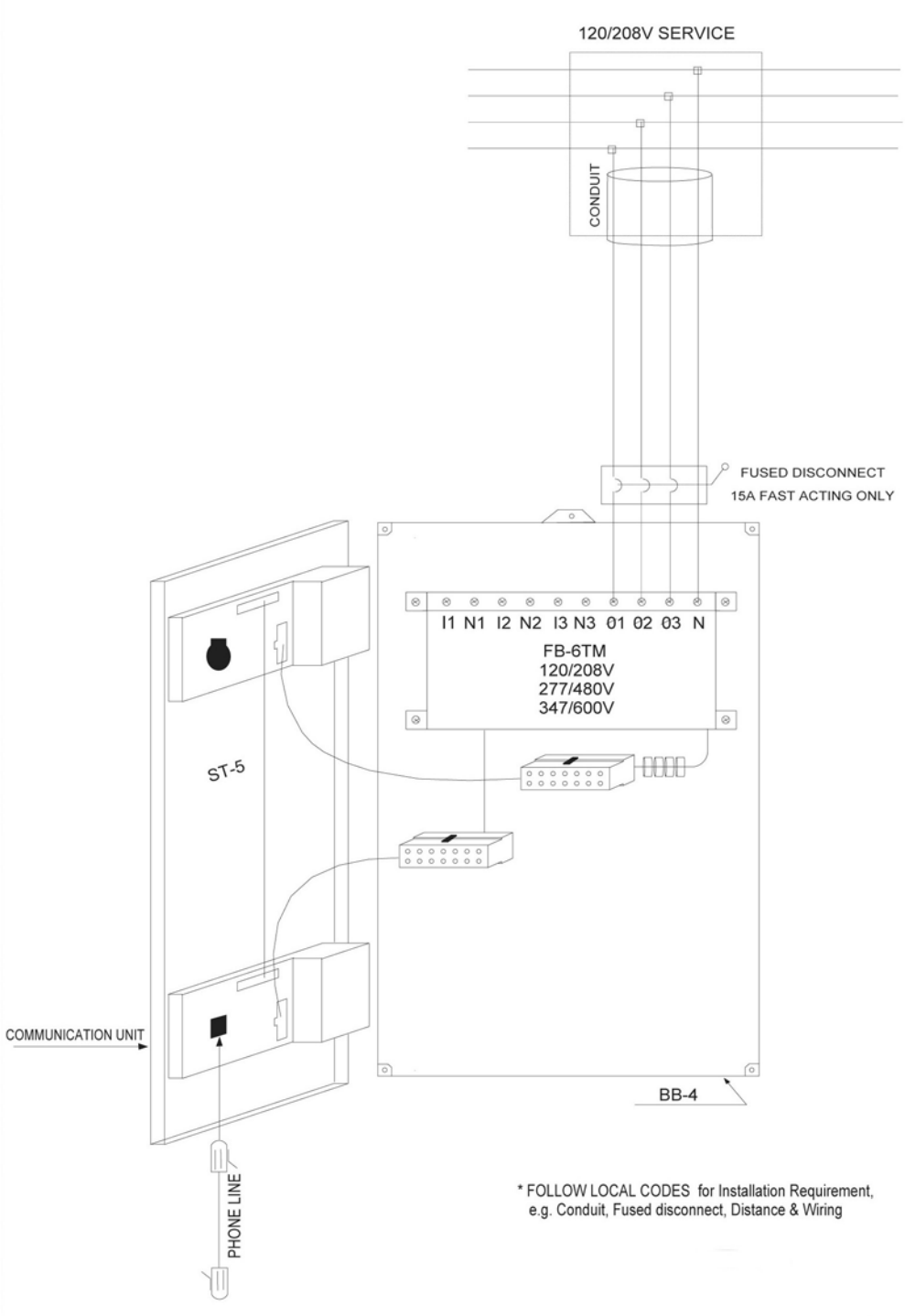

FIGURE A–2: Transponder - Wiring for Modem

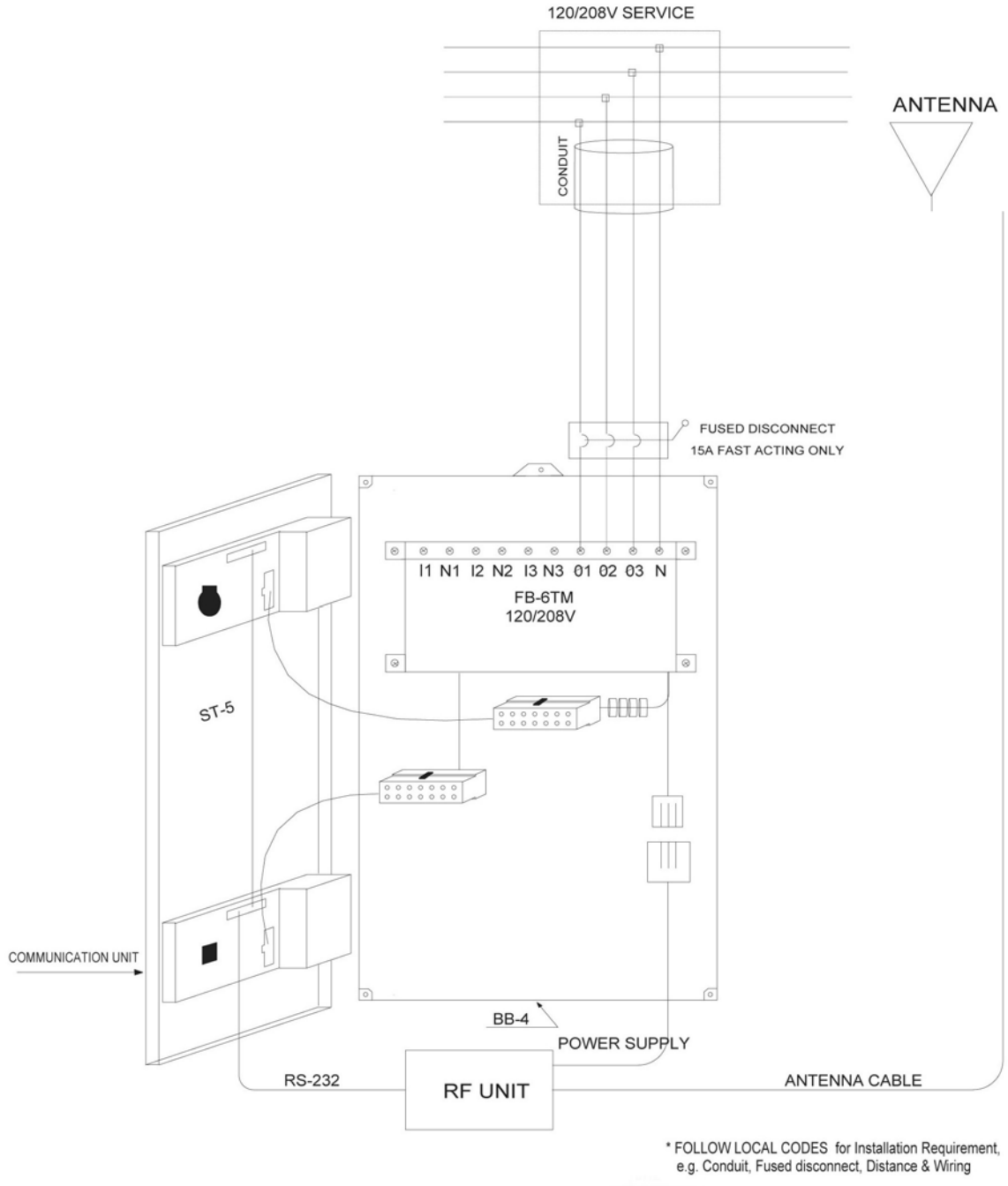

FIGURE A–3: Transponder - Wiring for Wireless

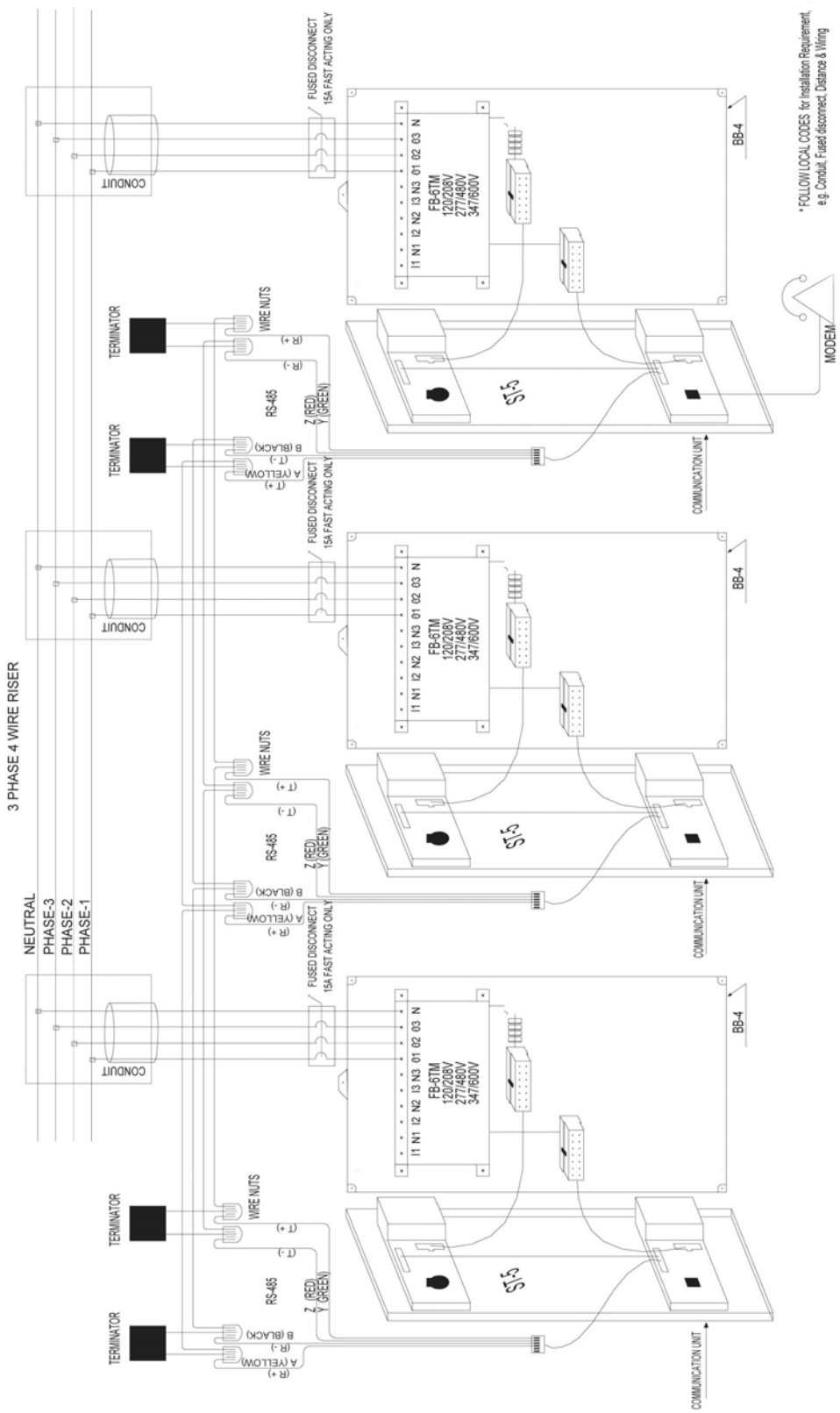

FIGURE A–4: Transponder - System Installation

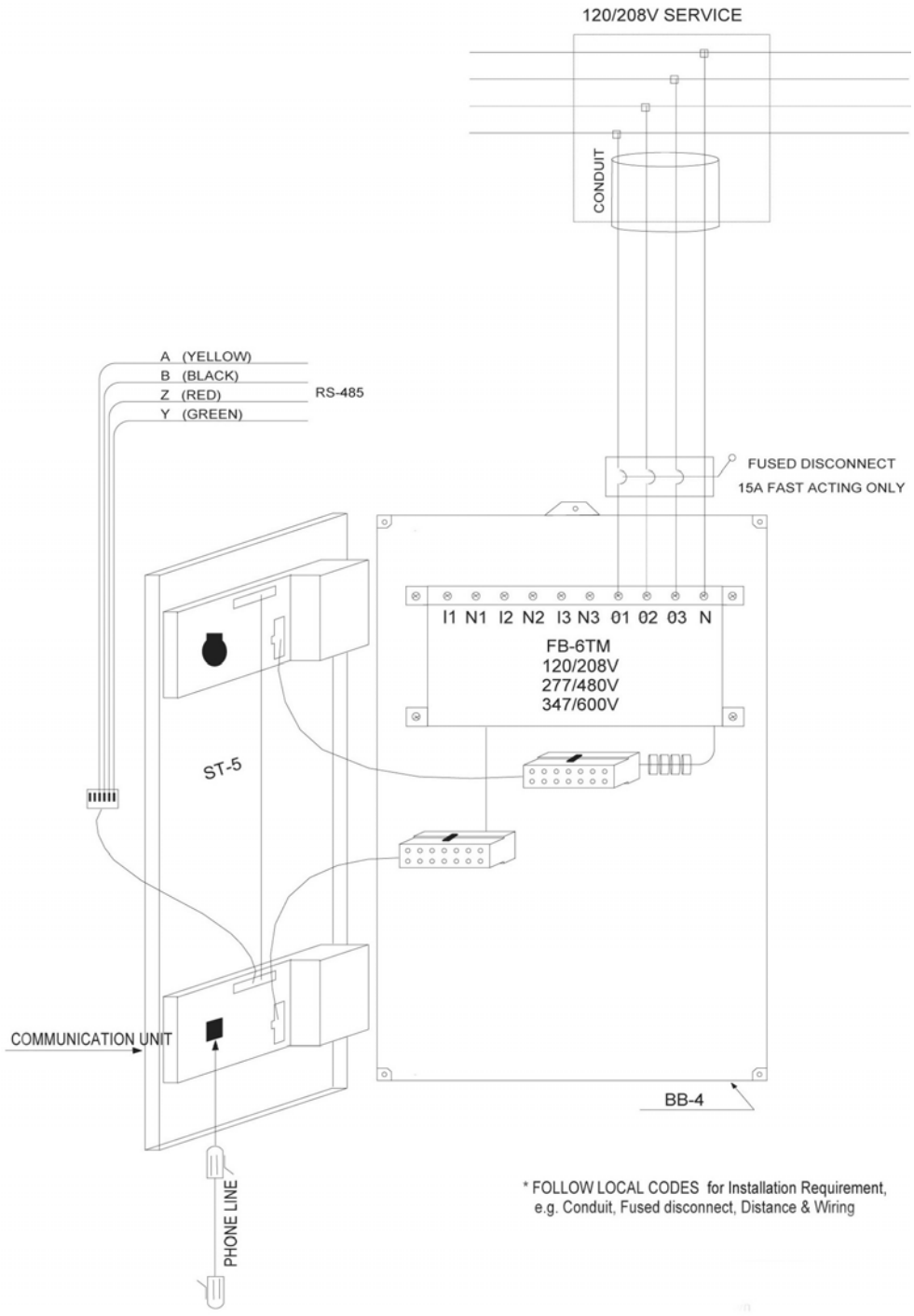

FIGURE A–5: Transponder - RS485 Installation