



HEXAGRAM, INC.

STAR Fixed Network Automatic Meter Reading System

STAR
Submetering DCU
Installation Guide

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INSTALLATION MANUAL

STAR Submetering Data Collector Unit

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Introduction

Becoming familiar with the Hexagram STAR system and its meter transmitter unit.

This manual is designed to instruct the installation professional on how to properly install a Hexagram STAR Data Collector Unit (DCU).

The first section is a brief overview of the entire STAR system that describes the system components and their functions.

STAR System

The STAR wide area, fixed network radio frequency system is a high performance, cost effective AMR system that automatically reads every meter every day from a central location – without the need for meter readers or vans. A STAR system can simultaneously handle water, gas, and electric meters as well as a variety of special purpose alarm, monitoring, and data-logging modules.

The STAR system combines advanced RF technology with an “inbound” (call-in) configuration. The configuration includes meter transmitter units, data collector units, and a centrally located network control computer.

STAR SYSTEM

Meter Transmitter Unit

Data Collector Unit

Network Control Computer

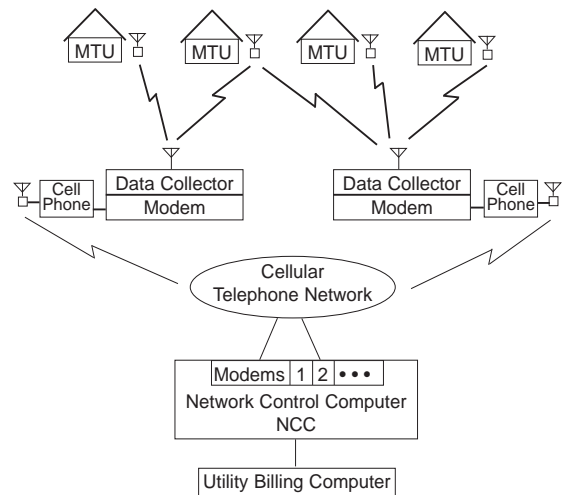


Diagram 1.1 STAR Wide Area Fixed Network System.

STAR System Components

Meter Transmitter Unit

Traditional Radio Frequency AMR systems require a receiver at each meter to listen for an interrogation signal. STAR meter transmitter units (MTUs), however, contain a timer and automatically transmit the meter reading data, usually twice a day. The number of daily transmissions can be increased for special situations.



All STAR radio transmissions utilize a high-power, narrow band signal on a FCC licensed channel. This insures that a clear channel will be available when the system is installed and that the channel will remain clear, free from interference and other users for as long as the system is in use.

STAR MTUs are completely self-contained and include a microprocessor, radio transmitter, radio antenna and battery in a hermetically sealed enclosure. The MTU is designed with a calculated 20-year battery life based on 2 transmission per day.

Two-Port MTU

Generally, most installations will use one MTU per meter. However, two-port MTUs are available which can service two meters. These MTUs can be connected, for example, to a gas meter and a water meter or can be used for dual-register compound meters.

Data Collector Unit

Radio transmissions from the MTU are received by STAR data collector units (DCUs) mounted in a network throughout the service area.

STAR DCUs are entirely self-contained and include a small computer, radio receiver and transmitter, a rechargeable battery, a charging unit and a standard telephone line for communication with the network computer.

A DCUs is typically installed in a utility room or attic. One STAR DCU will support several thousand meters in a typical installation.

The DCU decodes and error-checks data and stores it in memory. Once a day, it contacts a central network control computer and downloads readings, status, and maintenance information. DCUs can also be programmed to initiate an immediate call upon receipt of an urgent MTU message, such as a safety or security alarm.

Network Control Computer

All meter readings stored in each DCU are transferred to a centrally located network computer by a daily telephone call, typically late at night. STAR software processes the incoming meter readings and network performance information, loading it into a database system for storage and quick retrieval.



User-friendly screens allow easy viewing of the information and supply various options for generating reports. Data is also transferred to the billing system for accurate, timely issuance of customer billing statements.

Programmer



The Programmer, Psion hand-held computer, is designed to put computing power into the hands of the installation professional. It acts as an aide, giving the installation professional the ability to install, program, and test STAR MTUs.

The Programmer is lightweight, compact, and ergonomically designed for easy handling. Its rugged, weatherproof construction makes it strong enough to withstand considerable wear and tear and environmental extremes.

It contains a 16-bit processor, a powerful windowing, multi-tasking operating system, and 1 megabyte of random access memory. The Programmer is also available with a rechargeable battery.

Attachment of MTU Probe

A small interface module is attached to the back of the Programmer. Connected to it, via a six-foot cable, is the programming probe. When programming, this probe is held next to the MTU.

Recommend Installation Sequence

Network Control Computer

Data Collector Unit

Meter Transmitter Units

By following this sequence, the installation may be check to see that all portions of the system are working properly and have been correctly programmed.

Unpacking your DCU

Unpack the DCU from its shipping container

Contents should include:

- **Power Pak**
- **Wire for Power Pak**
- **Antenna Base with Allen Wrench**
- **Battery**
- **Antenna Mounting Plate**
- **Antenna Rod**

IMPORTANT

☞ You will need a laptop computer with HyperTerminal software installed to program your DCU

Additional Tools and Hardware required for installation includes: A Digital Voltmeter (DVM), a laptop computer with HyperTerminal software, screws and driver appropriate to attach unit to your selected mounting surface.

The area selected for DCU mounting must have:

- **Access to a standard telephone line (suitable for fax use)**
- **A constant source of 110vac, 60Hz power**

Submetering DCU Positioning and Mounting

Correctly positioning and mounting the data collector for optimum signal reception.

Determine the Physical Site and Prepare the Unit for Installation

Determine a suitable location for mounting the DCU indoors. Locate the unit in an area with uninterrupted 110vac, 60Hz power without a ground fault outlet or wall switch. ***Power must be available to the DCU at all times.*** Mount the unit high enough on a vertical surface to allow for placement of the UHF antenna. The DCU antenna comes with 10 - 15 feet of wire. Mount the antenna in an attic or in the rafters as high as possible. It can be mounted upside down, if necessary. ***Never mount the antenna horizontally.***

IMPORTANT

- ☞ Keep the antenna away from power lines, metal ducting or other metal surfaces
-

NOTE: The antenna must be mounted indoors. Consult Hexagram, Inc. if outside mounting is required: a lightning arrestor and other hardware will be necessary.

Attach the antenna rod to the antenna base with the Allen wrench supplied with your unit. Make sure that the rod is fully inserted into the base. Tighten the two Allen screws. Place the rubber gasket onto the antenna mounting plate base. Make sure it is seated evenly against the plate. Hand-tighten the antenna assembly to the base. Be very careful not to cross-thread the antenna.

Mounting

Mount the DCU to the wall using appropriate fasteners for the surface being applied, #10 size hardware should be sufficient in most cases. The DCU weighs approximately 30 lbs. Hardware is to be furnished by the installer.

Mount the antenna and route the antenna cable to the DCU. Attach the cable to the connector located in the lower left corner of the DCU. Be careful not to cross-thread the connector. ***Hand tighten, only.***

Unplug the cable to the DCU printed circuit board (PCB) located in the upper left corner of the PCB (J133).

Prepare the power cord with the following steps:

1. Strip 1 ¼ " of the outer jacket from each end of the supplied power cable. Be careful not to nick or damage the inner conductor.
2. From one end only, strip ¼" from each inner conductor.
3. Connect each lead to J105 (labeled "connect" 16vac transformer" – polarity does not matter)
4. Tighten each screw, making sure all strands are in the connector and are not shorting.
5. Route the wire through the grommet hold
6. Do not tighten the tywrap yet.

I M P O R T A N T

⇒ **Do not** plug in the Power Pak until instructed to do so.

From the other end of the power cable, strip ½" of the insulation from the inner conductors.

Wrap the wire in a clockwise direction around the screws on the power pack. Tighten each screw, making sure the wire is trapped fully under the head of each screw and that no strands from one screw short to the other. (Polarity does not matter since the output power of the power pak is 16vac.)

Connecting the Phone Line

Connect the telephone line to the DCU. This telephone line must be one that can be dialed out on during the evening hours without going through any PBX system. The telephone line should support long distance calls without requiring a code to dial out. It may be connected to a shared fax line if the fax line will not be used during the DCU's programmed call-in time. The DCU comes with a standard telephone plug that can be connected directly to a standard telephone jack. If this jack is being shared with a fax, a dual-port adapter should be used. In areas with frequent electrical storms, it is advisable to install a fax-style surge protector between the telephone connection and the DCU. This surge protector is to be furnished by the installer.

Alternate Telephone Installation

The DCU also comes with a telephone jack. This allows the installer to directly connect a wire from a telephone punch panel to the jack, if so desired. Wire for this installation option is not provided. Standard, 22 gauge, 2-conductor, solid telephone wire may be used. Use the "red" and "green"

terminals. Plug the cord from the modem into this jack, if this type of connection is used.

Once the phone line has been attached to the DCU, run the telephone wire out of the grommet. Tighten the tywrap around the phone wire and power cable after the wires have been routed and secured. This will provide some strain relief. Attach the wire to the walls with staples, being careful not to damage and short out the wires with the staples.

Connecting the Battery

Connect the fused cable assembly to the battery. Connect the "Red (+)" push-on connector to the "Red" tab on the battery. Connect the "Black (-)" push-on connector to the remaining tab on the battery. The cable contains a 10-amp fuse designed to protect the battery in case of a dead short. Press the battery into the Velcro fastener to secure it to the case. Plug the power pak into the 110vac-power outlet. Secure it to the outlet using the center wall-plate screw. The "Red" LED located on the power board should be lit indicating that 16vac power is present. Connect a Digital Voltmeter (DVM) to the battery. The resulting reading should be approximately 12.6vdc on a properly charged battery. Leave the DVM connected to the battery until instructed to disconnect it.

DCU Programming

Steps to correctly program the DCU.

Initial Programming

Connect a laptop computer to the DCU main board at J119, using a DB9 cable. The laptop should be running HyperTerminal software. Use the following HyperTerminal settings: Note: These instructions are for Windows 95. For Windows 98 instructions, see page 15.

```
Go to FILE –Properties
Connect using Direct to COM1
Configure: Bits per second:9600
    Data bits:8
    Parity: none
    Stop bit: 1
    Flow control: none
Settings: Function, Arrow, and Control keys, select “terminal keys”
Emulation: Auto-Detect
Back scroll buffer lines =500
```

With HyperTerminal on and the laptop connected to the DCU, plug the “Red” connector into the DCU PCB. Make sure all 4 pins plug into the J133. The laptop screen should display:

```
POR reset detected!! (power on reset)
Test SRAM for Good Records – (y/n)>

Type “n” for No (default is “Yes”, if no key is pressed).
Laptop will display “Overlaying Defaults”.
```

NOTE: The DCU will automatically step through the options.

The next display will be:

```

"HEXAGRAM INC STAR PROGRAM 2.92"
"FREQ.=4XX.XXXX MHz"
"CURRENT TIME/DATE=hh:mm:ss:mm:dd:yy"
"CURRENT RTC ALARM SETTING=XX:XX:XX"
"CURRENT UPLOAD TIME=XX:XX:XX"
"DCU UNIT NUMBERXXXXXX"

"DALLAS Up DETECTED"
"PIC LOAD SUCCESSFUL"
"OLD ALARM IGNORED"

```

Use the DVM to check battery voltage. Voltage should be greater than 13.2vdc indicating that the battery is being charged and that all connections are correct. Disconnect the DVM.

Verify Correct Information

From any screen, type "W": the laptop will display:

```

"HEXAGRAM INC STAR PROGRAM 2.808"
"FREQ=4XX.XXXX MHz"
"CURRENT TIME/DATE=hh:mm:ss:mm:dd:yy"
"CURRENT PHONE NUMBER=xxx-xxx-xxxx"
"PRIMARY PHONE NUMBER=xxx-xxx-xxxx"
"SECONDARY PHONE NUMBER=xxx-xxx-xxxx"
"EMERGENCY PHONE NUMBER=xxx-xxx-xxxx"
"DEFAULT ALARM TIME=XX:XX:XX"
"DCU UNIT NUMBER=XXXXXX"

```

```

DCU TEMPERATURE=XX.X DEG F
"BATTERY VOLTAGE <XXX XXX>=XX.XX Volts (This should be approximately the
same as the DVM reading)
"AVERAGE BRSSI(00)=-XXX.dB"
"CURRENT RTC ALARM SETTING=XX:XX:XX"
"RECORDS IN QUEUE=XXX"
"BYTE_POINTER=XXXX"
"DISCARDED_RECORDS=XX"

```

NOTE: The above information must be verified as correct. If any is incorrect, use the following procedure for correcting it:

IF THE FREQUENCY NEEDS TO BE CHANGED:

Press “F” for frequency entry. Enter the proper 9-digit frequency. Do not use any decimal points and fill in the trailing digits with zeros. For example, 451.0875 MHz would be entered as “451087500”. The DCU will then accept the number. "Enter" is not needed. The frequency programmed in the DCU must match the frequency of the MTUs being installed. The MTU label will indicate its programmed frequency.

IF THE ALARM/DOWNLOAD/CALL-IN TIME NEEDS TO BE CHANGED:

Press “A” for alarm entry. (Alarm entry is the same as “download” or “call-in time”.) Enter the alarm time in the 24:00:00 format. For example, 2:30:00 PM would be entered as “164300” – reading as “16:43:00” (colons are defaulted). Midnight is 00:00:00. "Enter" is not needed.

IF THE ID NUMBER NEEDS TO BE CHANGED:

Press “T” for ID entry. A 6-digit ID number should appear that was factory programmed. Do not change this number unless specifically instructed to do so. If no number appears, contact Hexagram, Inc. If a new board is required for a DCU, instructions for installing it and entering the ID number will be included with the board. "Enter" is not needed.

IF A TELEPHONE NUMBER NEEDS TO BE CHANGED:

Press “P” to enter telephone numbers. Press “PP” to enter the primary phone number. Enter this number; hyphens and commas are not needed. Press “Enter” to apply the number. When the primary number has been entered, press "P", then “S” to enter the secondary number. Enter the number and press “Enter” to enter the number. When the secondary number has been entered, press "P", then "E" .to enter the Emergency number. Enter this number using hyphens and commas. All three numbers may be the same or individual numbers may be selected. For initial installations, default numbers have been used.

IF THE SET-UP INFORMATION NEEDS TO BE CHANGED:

Press “X” to store the set-up information. This information needs to be written in the DCU’s FLASH memory. Once this is done, the set-up information will be available whenever the DCU is powered up or a reset occurs to the microprocessor. After pressing “X”, the DCU will ask for a password. Type in the password “sameold” (must be all lower case), then press “Enter”. If the password was entered correctly,

the DCU will display “GOOD PASSWORD!!!”, then “GOOD FLASH MEMORY WRITE!”.

Test Submissions

From the main program screen, type in “V”, laptop will display “VERBOSE” mode. If the display shows “TERSE”, retype “V” to change to “VERBOSE” mode.

After 1 minute, the laptop will display:

```
“Peak RSSI (XX)=-###dB...AVERAGE RSSI (XX)=###dB @ ”hh:mm:ss”
```

Every subsequent minute, the laptop will display an additional message in this format while it is in the “VERBOSE” mode. Note: The DCU will automatically leave “VERBOSE” mode at midnight.

To enter test records, hold the “Shift” key down and type “<”, then release both keys and quickly push “Enter”, the laptop will then display:

```
“Emptying circular buffer”
“Residual records added to SRAM=0”
“Total records now in SRAM=###”
{*****}
{*****}
```

NOTE: The “*” indicates an individual test record. The longer you wait to hit the “Enter” key, the more test records will be entered.

The laptop will display:

```
“RECORDS ADDED TO CIRCULAR BUFFER=###”
“EMPTYING CIRCULAR BUFFER”
“RECORDS ADDED TO SRAM=###”
“TOTAL RECORDS ADDED TO SRAM=###”
“TOTAL RECORDS NOW IN SRAM=###”
```

NOTE: At this point, the installer must call the administrator of the NCC that will be receiving the DCU’s calls. This will either be Hexagram, Inc. or another designated party. It is necessary to make sure DCU Serve is running on the NCC when installing the DCU so that test records may be received.

Hold the “Shift” key and type “>”, the DCU will attempt to make a call. During the call, test records will be transmitted. At the end of the call, the laptop will display:

```

"NCC Requested DISCONNECT!!"
"Upload terminated on...NCC request"
"Mod_Cmd +++"
"Modem Response=0"
"Modem Response OK!"
"Mod_Cmd ATH"
"Modem Response=0"
"Modem Response OK"
"Call attempt completed"

```

After the call is complete, type "W", the laptop will display:

```

"HEXAGRAM INC STAR PROGRAM 2.808"
"FREQ.=4XX.XXXX MHz"
"CURRENT TIME/DATE=XX:XX:XX XX-XX-XX"
"CURRENT PHONE NUMBER=XXX-XXX-XXXX"
"PRIMARY PHONE NUMBER=XXX-XXX-XXXX"
"SECONDARY PHONE NUMBER=XXX-XXX-XXXX"
"EMERGENCY PHONE NUMBER=XXX-XXX-XXXX"
"DEFAULT ALARM TIME=XX:XX:XX"
"DCU UNIT NUMBER XXXXXX"

"DCU TEMPERATURE=XX.X DEG F"
"BATTERY VOLTAGE <XXXXXX>=XX.XXXVOLTS...GOOD"
"AVERAGE BRSSI(XX)=-XXDB"
"CURRENT RTC ALARM SETTING=XX:XX:XX"
*"RECORDS IN QUEUE=0"
*"BYTE_POINTER=0"
*"DISCARDED_RECORDS=0"

```

***NOTE:** The values of the last three above items will go to "0" after a successful telephone call. This shows that the records transferred and cleared themselves from the DCU.

Wait until at least one MTU is installed to allow the DCU to receive actual MTU transmissions.

Test MTU Reception

From any screen, type "W", the laptop will display:

```

"HEXAGRAM INC STAR PROGRAM 2.808"
"FREQ.=4XX.XXXX MHz"
"CURRENT TIME/DATE=XX:XX:XX XX-XX-XX"
"CURRENT PHONE NUMBER=XXX-XXX-XXXX"
"PRIMARY PHONE NUMBER=XXX-XXX-XXXX"
"SECONDARY PHONE NUMBER=XXX-XXX-XXXX"
"EMERGENCY PHONE NUMBER=XXX-XXX-XXXX"

```

```

“DEFAULT ALARM TIME=XX:XX:XX”
“DCU UNIT NUMBER XXXXXX”

“DCU TEMPERATURE=XX.X DEG F”
“BATTERY VOLTAGE <XXX XXX>=XX.XXXVOLTS...GOOD”
“AVERAGE BRSSI(XX)=-XXDB”
“CURRENT RTC ALARM SETTING=XX:XX:XX”
“RECORDS IN QUEUE=X”
“BYTE_POINTER=X”
“DISCARDED_RECORDS=0”

```

NOTE: The “RECORDS IN QUEUE” value should be greater than 0 and the “BYTE_POINTER” will increase as a multiple of 34 times the records in queue. This indicates the MTUs are being received.

The following data must be verified:

The frequency must equal the issued frequency.

The current time and date must be entered and correct.

The primary, secondary, and emergency phone numbers must have been entered properly. If not, they must be corrected, as necessary.

The default alarm time must be entered.

The DCU number must be correctly entered. If not, correct as necessary.

Disconnect the laptop computer from the DCU.

Update the Service Log inside the metal case if any changes have been made that differ from the preprinted page.

Final Installation Steps

Double-check your work!

1. Battery Voltage > 12.6vdc and charging
2. Force phone call – records cleared?
3. Were all programmable data correct?
4. Did DCU complete phone call with test messages?
5. Did DCU receive real MTU messages?
6. Was service log updated?

DCU PROGRAMMING

Remove plastic bag with hardware from inside the DCU case. Insert the hasp into bottom of the case. Attach DCU cover and secure the case.

DCU Help Commands

Version 2.808 and higher

Keystroke	Description	Remarks
A	Set Alarm (call-in)	Format XX:XX:XX Colons automatically
D	Set	Format xx-xx-xx
E	Erase	Display will show "Erasing Records", please confirm
F	Frequency	Do not use decimal points, format xxxxxxxxx (9 places)
H	Help	Displays these
I	Set Identity	Changes DCU ID number, do not use unless
PP	Set Primary Phone	1-xxx-xxx-xxxx
PS	Set Secondary Phone	1-xxx-xxx-xxxx
PE	Set Emergency Phone	1-xxx-xxx-xxxx
R	Read RTC Time/Date/Alarm	Will display time, date, alarm call-in
T	Set RTC	Sets DCU clock
V	Turn on modem print Verbose	DCU must be in verbose mode during set-up
W	Print header	Shows all current settings on laptop
X	Overwrite FLASH	DCU will ask for password to do
Shift ">"	Activate calling	Forces phone call to
Shift "!"	Display stored	Display records to laptop. Hit "ESC" to end.
Shift "<"	Generate test	Will continue until you hit "Enter"
Z	Turn Phone Power & Modem	Press "ESC" to turn off – diagnostic use

Instructions for Using Windows 98 and HyperLink

Click on HyperTerminal, "New Connection Description" window will appear. Type in the name you wish to call the new connection and click an icon you want to associate with it.

"Connect To" window will come up. Click on arrow next to box, connect using and select direct connect to COM 1.

The "Port Settings" window will open. Configure it as follows:

Bits per second = 9600

Data Bits = 8

Parity = None

Stop Bit = 1

Flow Control = None

Click "OK"