

Mercury 200 Cable Modem MFG System

DataSheet



Revision 1.1

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1. Overview

The DAQTron Mercury 200 System enables very high volume manufacturing of cable data/voice modems or cable settop boxes. The Mercury 200 System is used by several contract manufacturers, for which a typical situation is shown in Figure 1. Production volumes of 16K modems per day are assumed, however, the Mercury 200 is “granular” enough that the customer or CM can easily configure for different production volumes.

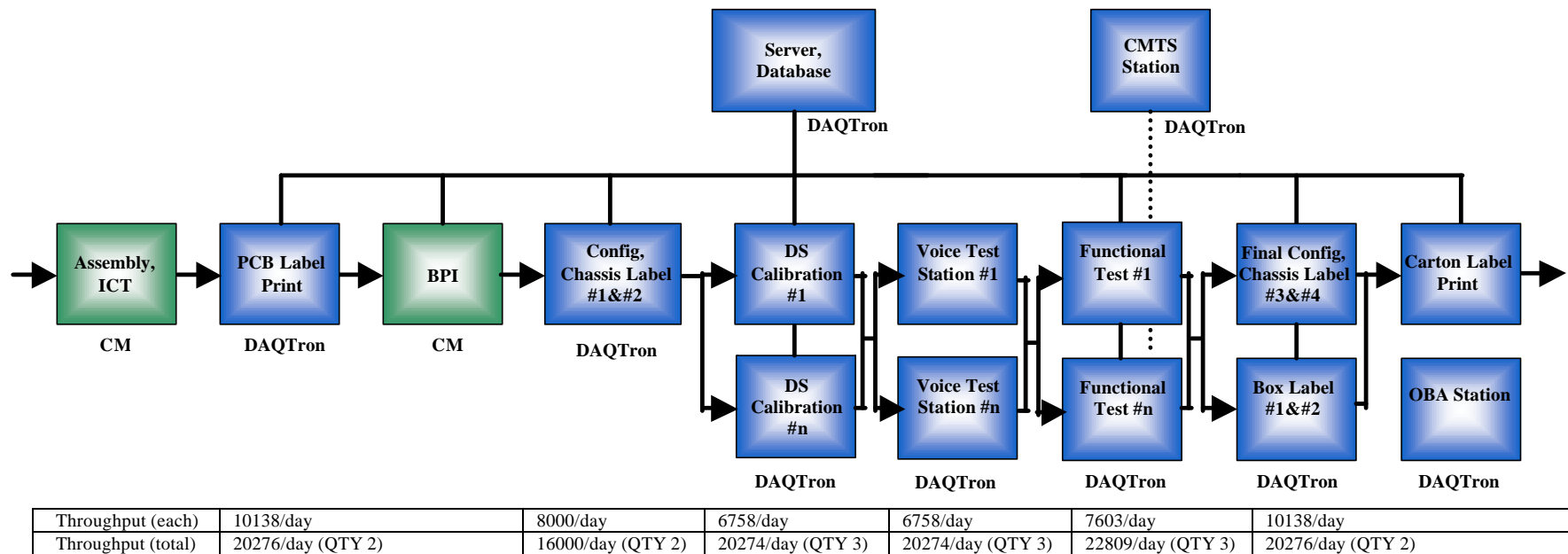


Figure 1. Mercury 200 Cable Data Modem Manufacturing Line (throughput assumes 22 hours per day, 96% yield)

The primary components of the DAQTron manufacturing line are the Calibration Station, Voice Test Station, and the Functional Test Station. All have data and configuration management provided by a single server station. A single CMTS station with multiple CMTSs supplies upstream / downstream signals to the Functional Test Station and OBA Station. This datasheet gives details regarding those parts of the production line test supplied by DAQTron.

2. PCB Label Station

This station is used to generate PCB barcode labels. The labels can then be attached to the PCB. Numerous labels can be printed out simultaneously, thus typically only one PCB Label Station is necessary to achieve high volume manufacturing.

3. Pre-Configuration Station

This station is used calculate and store chassis serial number and simply consists of a PC with 2 ethernet interfaces, bar code scanner, and DAQTron software.

4. Configuration / Chassis Label Station

This station is used to scan PCB # from a barcode label on PCB, add MAC addresses and Serial Numbers to the static database (ensuring no duplicates), set the factory configuration MIBs, and start an entry in the production database. After configuration, the chassis is assembled and the UUT is completely enclosed.

This station is also connected to label printers with the print application running in the background and polling for new MAC addresses present via SNMP. A remote test fixture for Ethernet and powering the enclosed unit is supplied by the customer. The label printer is located at this test fixture and prints out the chassis label for the UUT. Cycle time with operator connect/disconnect is 15 seconds per UUT. Each station contains two PCs and two label printers, giving an effective 7.5 seconds per UUT or 10,138 per day.

5. Calibration Station



The DAQTron Mercury 200 Calibration Station performs downstream calibration of multiple UUTs in parallel. The station has connections for 32 UUTs; 16 of which are calibrated simultaneously. While one bank of 16 UUTs is being calibrated, the other is being connected. A vector signal generator (VSG) is used for generation of downstream signals to the UUTs.

- Hardware from VSG to each of the UUT ports is matched to within +/-0.25 dB. DAQTron supplies high quality BNC-to-BNC cables to connect to a customer supplied test fixture.
- A National Instruments (NI) PXI system contains Ethernet connections for all 32 UUTs. Communication with UUTs is performed by UDP, Telnet, or SNMP via these Ethernet connections. The PXI system also contains the NI-5670 RF Signal Generator for QAM signal generation of DOCSIS and EuroDOCSIS signals.
- Power outlets for the 32 UUTs are not contained within the DAQTron system and should be supplied by customer. It is further recommended that fixturing is provided by

customer for each product type to be tested, and the fixture should contain connections for power, RF, and Ethernet.

- The number of points for downstream calibration is configurable by administrator. For 17 power levels and 17 frequencies in the downstream, calibration times are approximately 3 minutes for 16 DOCSIS modems and 4 minutes for 16 EuroDOCSIS modems.
- Continuous testing is possible since a second set of 16 modems can be connected while calibration is being performed on the first set of 16 modems. Assuming 22 hours day, 96% yield, and the test times listed above, each calibration station can test 6758 UUTs per day.
- CMTS connection is not required.
- LEDs indicate running, pass, and fail for each UUT.
- DAQTron supplies documentation with details for operation, configuration, maintenance, and troubleshooting.

6. Voice Test Station



The DAQTron Mercury 200 Voice Test Station performs signaling and voice frequency measurements on 24 telephony lines simultaneously. Testing is performed using National Instruments signal generation and acquisition hardware in conjunction with DAQTron voice interfaces.

- A custom DAQTron Voice Load Interface is used to apply terminations between all tip-ring pairs simultaneously. These terminations include all real, complex, and REN impedances necessary.
- A custom DAQTron Switch/Attenuation Interface is used to couple generated voice frequency signals onto telephony lines and to condition signals prior to input to signal acquisition hardware.
- An NI-5421 16-bit Arbitrary Waveform Generator and DAQTron interfaces supply VF signals to UUT lines under test. UUT firmware enables cross-connection of telephony lines. After proper loading of lines under test with DAQTron interfaces, an NI-4472 24-

bit acquisition card samples 8 signals simultaneously. DAQTron hardware multiplexes 8 UUT lines to A/D card.

- A National Instruments PXI system contains Ethernet connections for all 12 UUTs. Communication with UUTs is performed by UDP, Telnet, or SNMP via these Ethernet connections. This system also contains the NI-5421 and NI-4472 modules.
- Tests are performed to determine loop currents, line voltages, on/off hook states, ringing parameters, DTMF and dial tone generation/detection, echo return loss, idle channel noise, and voice frequency parameters versus amplitude and frequency.
- Power outlets for the 12 UUTs are not contained within the DAQTron system and should be supplied by customer. It is further recommended that fixturing is provided by customer for each product type to be tested, and the fixture should contain connections for power, RF, and Ethernet.
- Continuous testing is possible since successive sets of 4 modems can be connected while testing is being performed on the other set of 4 modems. Total test time for each bank of 4 two-line UUTs is approximately 45 seconds. Assuming 22 hours day, 96% yield, and the test times listed above, each Voice Test Station can test 6758 two-line UUTs per day.
- Calibration software and procedures for the station are provided by DAQTron.
- LEDs indicate running, pass, and fail for each UUT.
- DAQTron supplies documentation with details for operation, configuration, maintenance, and troubleshooting.

7. Functional Test Station



The DAQTron Mercury 200 Functional Test Station performs CMTS registration, upstream calibration and verification, and network traffic testing on cable modems. Multiple modems are connected and tested in parallel. The process continues until all UUTs have been tested.

- A custom DAQTron RF Test Interface is used to route twelve UUTs to the CMTS. Four modems are tested simultaneously at each CMTS DS/US condition. There are three CMTSs, allowing tests to be performed at different conditions for each set of four modems. Two Functional Test Interfaces are included in the system for connection of up to 24 UUTs.
- Calibration software and procedures for the station are provided by DAQTron. Correct calibration ensures that measurement results are accurate to within +/- 0.25dB over the measurement bandwidths of interest.
- Power outlets for the 24 UUTs are not contained within the DAQTron system and should be supplied by customer. It is further recommended that fixturing is provided by

customer for each product type to be tested, and the fixture should contain connections for power, RF, and Ethernet.

- Two rack mounted PCs contain Ethernet connections for all 24 UUTs. Communication with UUTs is performed by UDP, Telnet, or SNMP via these Ethernet connections.
- CMTS downstream lock is performed by commanding UUT downstream frequency via firmware and querying CMTS for lock. The CMTS for the manufacturing lines will be fixed with three downstream frequencies, but the number of power levels at these frequencies is configurable by administrator. With each modem registering at three upstream/downstream conditions, the approximate test time per modem per upstream/downstream condition is 60 seconds. **Note:** This time may be shortened if the modem designer can improve registration time.
- Network traffic tests are performed with packets sent from PXI Ethernet interface to CMTS. The number of bytes, packets, and rate are configurable by administrator.
- Twenty-four UUTs are tested in approximately 3.5 minutes. Assuming operator connect / disconnect time from the test fixture of 30 seconds and 96% yield, this translates to a capacity of 7603 UUTs per day for this station.
- LEDs indicate running, pass, and fail for each UUT.
- DAQTron supplies documentation with details for operation, configuration, maintenance, and troubleshooting.

8. Final Configuration Station

The DAQTron Mercury 200 Final Configuration Station consists of a standard PC with Ethernet interface to communicate with the UUT. The station can verify that all tests have passed on the UUT, print bar code labels, and then turn off all factory MIBs. The included barcode scanner is used to scan chassis label and verify internal modem settings.

This station is also connected to label printers with the print application running in the background and polling for new MAC addresses present via SNMP. A remote test fixture for Ethernet and powering of the enclosed unit will be supplied by customer. The label printer is located at this test fixture and prints out multiple chassis labels for the UUT. Cycle time with operator connect/disconnect is 15 seconds per UUT. Each station contains two PCs and two label printers, giving an effective 7.5 seconds per UUT or 10,138 per day.

9. Carton Label Print

The DAQTron Mercury 200 Carton Label Print Station consists of a standard PC with bar code scanner to read chassis labels for all UUTs in a carton. A large carton label that contains all carton UUT information is then printed.

10. Server Station

The DAQTron Mercury 200 Server Station consists of two identically configured “super” PCs. Each PC contains a standard hard drive, Ethernet interface, with the operating system and application software installed. Only one PC is used at a given time; the second is for redundancy in case of failure. A separate, but connected, large RAID hard drive is used for reliability. The software on the server is used for updating configurations of all production test stations. In addition the server contains all Mercury System databases. Stations interact constantly with Server to query modem status and information and post data to Mercury databases. **Note:** Front end database software for generating statistics and reports is very customized for each manufacturer, and thus DAQTron does not currently supply this component. This feature may be provided in the future.

11. CMTS Configuration Station

This station contains six CMTSs; three DOCSIS and three EuroDOCSIS. The signals from the CMTS are routed to the Mercury 200 Functional Test Station, Voice Test Station, and OBA Station. The PC at this station is used for configuring the CMTSs and is able to control signal level and signal/noise level of CMTS signals. A DAQTron CMTS interface is used for duplex filtering, noise injection, and control of upstream and downstream signal levels and noise levels.

12. Out-of-Box Assurance (OBA) Test Station



Functional Tests, RF Spurious Tests, and Voice Tests are performed on the OBA station on a sampled percentage of units from the production line. This station is also used for PHY-21 verification of units that have been calibrated at the Calibration Station.

Typically, about 3-5% of manufactured UUTs are sampled for testing on the OBA station.

13. Summary

Please contact DAQTron for details regarding shipping, factory setup assistance, warranty, support, schedule and costs.