

Forté 8760 Series

Maintenance & Troubleshooting Manual

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1. INTRODUCTION

The purpose of this manual is to assist the customer maintenance personnel in understanding the maintenance requirements of the FORTÉ Series 8760 Moisture Measuring System. It includes routine care, operational checkout, locating causes of malfunctions, and necessary corrective action. It also includes a brief description of how the FORTÉ System functions operationally.

2. SYSTEM HARDWARE

The FORTÉ system equipment is located in two main areas. The console with the computer is near the production area. The signal generator, the sensing electrode, the photo control unit and reset photo eye are attached to the bale press.

2.1. CONSOLE EQUIPMENT

The FORTÉ computer is enclosed in an upright console (NEMA Type 12) with the interface panel mounted on the inside of the bottom section. The computer and monitor sit on the top shelf with the Hostess serial I/O unit mounted internally to the console support structure. The keyboard is located in the pull out shelf located below the viewing window.

All cables should be securely fastened to the mating connectors in the console with the provided hardware.

The interface panel includes a terminal block to tie-in the main AC power, the solid state relay boards for digital I/O signals, a DC power supply and a terminal block for the signal cable and digital I/O connections.

The input power is connected to a terminal strip on the interface panel.

A ground bus is installed in the console. A customer-supplied earth ground is recommended.

The optional printer is located outside the console.

2.2. FIELD EQUIPMENT

The signal generator and sensing electrode assembly are mounted on the bale press ram. The signal-microprocessor measures the Forte reading which in turn determines the moisture content of the bale.

The scale readout and weigh conveyor are located in the production line conveyor system. The weigh conveyor transports the bale onto the scale. After the bale settles on the scale the PLC sends a “Weight Ready” signal to the Forte system. The Forte system requests and receives a weight from the scale display.

FORTÉ recommends that all external cabling which connects the FORTÉ electronics to the scale and to the FORTÉ console be run separate from existing high voltage AC cables.

2.3. SCHEDULED HARDWARE MAINTENANCE

FORTÉ recommends that the following areas be checked and cleaned on a regularly scheduled basis:

Clean the electrode and cover plate as required. Remove stray pieces of product and wrapper material.

Clean the surfaces of the electrode. A common household ammonium chloride based cleaner may be applied by spray bottle. Isopropyl alcohol may also be used clean the electrode and cover surfaces.

Keep the reset photo switch components aligned and the lenses free of contaminants.

Inspect all external cables for wear and abuse.

Inspect all ground connections. These ground straps are either flexible, tinned copper braid, or copper welding cable.

3. SYSTEM OPERATION

When the bale buildup on the layboy is completed the drop is lowered to the conveyor line and is transported towards the scale and press.

In the case of flash-dried pulp, the bale is transported from the slab press to the bale press.

In either case, when the bale comes to rest on the scale the PLC sends a "Weight Ready" signal to the Forte system. The Forte program requests the scale to send the weight to the Forte. The weight is compared with the global weight limits and if within the limits a "Weight Accepted" signal is sent to the PLC. If the weight is outside the global limits the appropriate "Weight Heavy" or "Weight Light" signal is sent to the PLC. If the control system is not in the "Weight Override" condition, only weights within the limits are accepted as valid weights. If the control system is in "Weight Override" condition, all weights within the range set in the System Constants Menu are accepted as valid bale weights. All valid bale weights are stored in a single memory file.

With the weight accepted, the bale proceeds to the press. During the press cycle the Forte oscillator frequency is measured at two different points as determined by the light beams in the photocontrol unit. The oscillator output pulses are counted for precisely 100 msec each time. The difference in the two measured frequencies is called the Forte number. This number is matched to the oldest weight in the weight memory and stored in a Weight-Forte memory file.

The bale proceeds down the conveyor line, through the wrapper and tying machines. When it reaches the marker, the PLC sends an "At Marker" signal to the Forte system. At this point the Forte program processes the bale data using the grade and calibration parameters in performing the calculations. The bale data is displayed on the monitor (bale data menu), outputted to the printer if desired, and outputted to the plant computer. The marker message as programmed in the Marker Menu is also sent to the marker.

The bale data is added to the lot, shift and day summaries. These summaries are closed and outputted at the completion of the lot, the end of the shift and day, respectively.

4. STANDARD TROUBLESHOOTING PROCEDURES

When a malfunction of the Forte system occurs, the operators contact the maintenance personnel to fix the problem. The maintenance technician is expected to go to the Forte console to determine the problem. The Forte program has many diagnostic features to assist in locating the fault. The maintenance man should follow the steps below to accomplish this task.

4.1. STATUS HISTORY MENU

Display the Status History menu and review the error messages. If an error message or group of error messages are displayed, the message number indicates the problem area. This may be a scale, press, or marker error. The operation error messages can be verified by observing the System Schematic menu and the finishing line.

4.2. SYSTEM SCHEMATIC MENU

Display the System Schematic menu and compare its functioning with the actual bale finishing line. There are three blocks representing the scale, the press, and the marker with two interconnecting lines representing the connecting conveyors. Each time a bale reaches the scale, is pressed, or reaches the marker, the appropriate block updates. The block will turn red for a second to easily recognize the update. The number of bales on conveyor 1 represent the number of bales that have been weighed (weight within limits) and not yet pressed. The number of bales on conveyor 2 represents the number of bales that have been pressed but have not yet reached the marker.

If the actual finishing line and the display are not in agreement, appropriate error messages will occur and the problem area is easily identified.

4.3. DIAGNOSTIC MENU

Display the Diagnostic menu to observe the digital I/O's and determine if any of these signals are faulty and causing the problem. The maintenance man can also check the scale and oscillator communications with the test routines on this menu.

5. ERROR MESSAGES IN THE FORTÉ SYSTEM

Whenever there is a malfunction in the Forte System error messages are generated and displayed just above the bottom box and placed in the “System Log”. These error messages describe the malfunction and indicate the problem area. Below are a number of operational error messages and possible solutions. To avoid any complications and preserve clarity the error message level and number have been omitted.

5.1. ERROR: SCALE: WEIGHT OUT OF RANGE

When this error appears the scale block on the System Schematic menu remains red until a valid weight is accepted. This may occur when the weight ready signal is received too early or too late. It will also occur when the weight limits are tight and the bale weight is outside the limits.

5.2. ERROR: SCALE: RECEIVED TIMEOUT ERROR

When this error appears it means that the Forte system requested a weight from the scale but no weight transmission was received. This error message is normally accompanied by a second error message stating **ERROR: SCALE: RETRY UNSUCCESSFUL ON LINE?** This simply means no weight was received on a second weight request. This can occur when the scale motion detector is active and the scale has not settled and is still vibrating. Go to the Diagnostics menu and perform the scale test to verify the communications.

5.3. ERROR: SCALE: BALE FORCED PROCESSED

When this error appears it means the system has more than the allowed number of weights in memory and processes the oldest weight through the press cycle by using the make-up Forte reading. This condition occurs when a valid Forte reading has not been generated during a press cycle.

5.4. ERROR: PRESS: FORTE OUT OF SYSTEM RANGE

When this error appears the press block on the System Schematic menu remains red until a valid Forte reading is accepted. This may occur when the Forte limits are tight and the Forte reading is outside the limits.

5.5. ERROR: PRESS: DATA RECEIVED WITH NO BALES ON CONVEYOR

When this error message appears it means the bale tracking system through the finishing line is out of sync. The tracking system did not have a pressed bale available to go through the marker station. The System Schematic menu must be made to agree with the production line by incrementing or decrementing the number of bales on the two conveyor lines. Conveyor 1 represents the number of bales that have been weighed but not yet pressed. Conveyor 2 represents the number of bales that have been pressed but have not yet reached the marker. At this point both the production line and System Schematic should be observed to determine what is causing the bale tracking to go out of sync.

5.6. ERROR: PRESS: TOO MANY BALES ON CONVEYOR - BALE PROCESSED

When this error message appears it means the bale tracking system through the finishing line is out of sync and that there are too many bales waiting to reach the marker. The Forte program automatically processes the oldest bale data and loads the marker. This condition will occur if, a number of pressed bales are removed from the finishing line before they reach the marker without the delete digital signal being activated for each such bale removed.

6. SYSTEM SCHEMATIC AS A TROUBLESHOOTING TOOL

In normal operation the System Schematic menu reflects what is happening on the finishing line. A bale stops on the scale to be weighed. The scale block in the menu turns red for a second with the updated weight and Conveyor 1 (bale weighed) bale number is incremented. The bale continues to the press. During the press cycle, the press block in the menu turns red for a second with the updated Forte reading, Conveyor 1 is decremented, and conveyor 2 (bale pressed) is incremented. When the bale reaches the Marker station, the marker block in the menu turns red for a second with the bale data updated and Conveyor 2 number of bales decremented. In addition, the bale data at the bottom of the display is also updated. Any variation from this routine indicates the area at fault.

7. MARSH MARKER OPERATION

Many pulp systems utilize a Marsh marker to stencil selected data onto the bale. The Forte bale data transmission to the marker is done without "handshake". To guarantee valid communications without "handshake" the baud rate must not exceed 2400. Whenever the local keyboard is used (purging the marker) the baud rate is automatically changed to 9600. This means that when the Forte system is re-connected to the marker the baud rate must be changed back to 2400.

To change the baud rate first power down the Marsh marker. Disconnect any communication cable connected to the marker. Power up the marker for about ten seconds with no cable connected and then power down the marker. The Marsh marker interprets this as a need to change or check the baud rate. Connect the Forte cable to the marker and power up the marker. Both the photocell and Data In indicators will light and then the Data In light will go out. At the Forte console, with the Marker menu displayed, highlight the INIT STRING. This string should contain a single carriage return (either <CR> or {0D}). Depress F8 (send string) once to send the single carriage return signal to the marker. The marker measures the duration of the start bit to determine the baud rate and changes its baud rate accordingly. This process takes approximately 7 seconds. No other transmission should be made during this time. The Data In light will be lit if the baud rate change was successful.

To verify the communications between the console and the marker, send the test string to the marker. The initial character must be 04H (clear the print and entry buffers) and the final character must be 01H (load the input buffer into the print buffer). The test data must be in upper case characters, as the marker does not recognize lower case characters as printable characters. After the test string has been sent, pass a sheet of pulp by the marker ink jets to verify the test message.

8. PROBLEMS OF THE FORTÉ SYSTEM

If the Forte system is not receiving weight data and there are no scale error messages, check the Diagnostic menu to verify that the system is receiving the digital "weight ready" signal. If the Forte system is not receiving weight data and a Timeout error message is displayed, perform the scale test on the Diagnostic menu. If there is no communications, check the baud rates of the scale and console weight inputs. If these agree, check the scale setup. If a weight is received but not accepted, check the validity of the weight limits. In this case the scale block on the System Schematic menu will turn red and remain red until a valid weight is received.

9. PRESS PROBLEMS OF THE FORTÉ SYSTEM

If a system malfunction gives an error message, the press electronics may not be functioning correctly and the system may not be receiving Forte readings. By observing the System Schematic the press block should update when a bale is pressed. If this is not the case, first perform the oscillator test in this menu. If unsuccessful, the oscillator mounted on the ram may be faulty. If the oscillator test is successful, the photocontrol unit may be faulty.

If the oscillator is at fault, it can be replaced or a further check of the oscillator DC supplies can be checked at the press. With the cover removed, connect the ground end of a digital voltmeter to the chassis ground and locate the white wire with a red tracer. The voltage should be +12 VDC plus or minus 1 VDC. Next, locate the red wire with the white tracer. The voltage on this wire should be -12 VDC plus or minus 1 VDC. The last wire to check is the red wire without a tracer. This should be +5 VDC plus or minus 0.25 VDC. If the system uses a local power supply at the press and the voltages are not as specified, replace the power supply. Otherwise, replace the oscillator.

If the photocontrol unit is at fault, it can be replaced or further electrical tests can be performed. With the cover removed, connect the ground end of a digital voltmeter to the chassis ground and locate the white wire with a red tracer. The voltage should be +12 VDC plus or minus 1 VDC. The next wire to check is the red wire without a tracer. This should be +5 VDC plus or minus 0.25 VDC. The final thing to do is to remove the cable at the J2 connector and insert the positive voltmeter lead. The voltage should be -12 VDC plus or minus 1 VDC.

To perform the functional test on the photocontrol unit, connect the positive digital voltmeter lead to the jumper connecting the B and C terminals on the board. Block the reset photo beam and then permit it to re-make. The voltage should be approximately 0 VDC (Logic 0). Block the upper photo beam and the voltage should become approximately 4 to 5 VDC (Logic 1) and remain at this level. Once again block and re-make the reset photocell beam. The voltage should return to Logic 0. The next check to perform is to verify the down count signal. Attach the digital voltmeter positive lead to the gray wire. The voltage should be Logic 0 (approximately 0 to 0.5VDC). Block the lower beam in the photocontrol unit and the voltage should change to a Logic 1. With the beam made the voltage is at Logic 0 and with the beam broken the voltage is at Logic 1.

9.1. PROGRAM MAINTENANCE VIA THE 8760 MMS WINDOW

The FORTÉ 8760 MMS Window displays the bale line operation. When a bale exits the press, the Forte reading and bale weight are updated. This updating procedure repeats for each bale that passes through the press station. Operators and maintenance personnel may observe this operation while standing at the console.

The FORTÉ 8760 uses the Control RocketPort serial interface for the connection of field serial devices to the system. Configuration settings for the 8-port serial interface can be accessed from the Windows NT Start menu by selecting Programs, Control RocketPort RocketModem, RocketPort Setup. Name of the device is ROCKET #1. The eight COM ports are defined as COM 3 through COM 10.

The FORTÉ 8760 MMS Window contains a drop down Setup menu that includes a Devices submenu window. The Devices window was designed for operational checks and maintenance assistance. In addition, this menu is programmed to test the oscillator frequency and the communications with the scale. The oscillator frequency should be logged at defined intervals to verify the stability of the oscillator.

The Devices Window sets up the console serial communications byte format and baud rates to agree with the respective field equipment. The COM ports are also designated in this window. These communication links are set up at installation and should not require any changes unless changes are made in the field equipment.

Default serial communication settings for the scale and oscillator should match the following:
Note: Port numbers are assigned during installation and may differ.

Device	Station	Port	Baud	Data	Stop	Parity	Online	Sim
Scale	103	3	4800	7	1	Even	True	False
Osc	103	4	1200	8	1	None	True	False

NOTE: By clicking on the line of setup data for the scale or the oscillator, and then clicking on the Online button, the status of the device can be changed from True to False. When the device status for Online is False, the device is not recognized by the assigned port.

The Digital I/O window permits the maintenance personnel to observe the FORTÉ system digital inputs and the digital output as they occur. The inputs include Weight Ready 1 and Weight Ready 2 which identify the Dryer/Bale Press line source of the bale. The output is a Weight Accept signal.

9.2. PROGRAM OPERATIONS WINDOWS

The normal display windows are the FORTÉ Measuring System window and the Summary window. The measurement data is displayed on a system schematic and in different summary formats as items are processed.

All maintenance personnel who may be called to work on the Forte system should also be aware of two Setup menu commands on the Measuring System menu bar, Devices and Digital I/O.

Other menus involved in the operation of the FORTÉ system include the Product Definition Subsystem (Type/Grade/Stock/Fiber) Menu and the Calibration Subsystem Menu.

9.3. PROGRAM SUPERVISORY MENUS

Supervisory or laboratory personnel normally enter data into the Product Definition Subsystem (Type / Grade / Stock / Fiber) and into the Calibration Subsystem. Changes in these menus occur only rarely and do not involve maintenance personnel. There are mentioned here only to inform maintenance personnel of their presence.

The Product Definition Subsystem (Type / Grade / Stock / Fiber) menu is accessed through the Applications drop down menu on the Measuring System window. Select Open Product Definition to bring up the window. Product types are defined in this window and associated with predefined calibrations.

The Calibration Subsystem menu is accessed through the Applications menu on the Measuring System window menu bar. Select the Open Calibrations command to bring up the Calibration System window.

The Samples for Calibration submenu is opened from the Calibration System window. Laboratory personnel enter calibration constants directly into the Calibration System window, or enter collected moisture data into the Samples for Calibration window to determine the calibration constants necessary to calculate the moisture content of each bale.

10. PRINCIPLES OF THE FORTÉ SYSTEM

In order to appreciate the calibration requirements and the interaction of the units comprising the FORTÉ system, it is necessary to understand how the system functions and why it works. This section gives a brief description of the FORTÉ system.

10.1. BASIC THEORY

The heart of the FORTÉ Moisture Measuring System is a modified Hartley type oscillator. The resonant frequency of the oscillator is controlled by an LC tank circuit as shown in Equation 1.

$$F_r = k/(LC)^2 \quad (\text{Equation 1})$$

where F_r = resonant frequency
 k = proportional constant
 L = tank circuit inductance
 C = tank circuit capacitance

With the tank circuit inductance fixed, any change in the resonant frequency must be caused by a change in the tank circuit capacitance. In the FORTÉ system, all capacitance involved in the tank circuit effective capacitance are fixed except the capacitance of the test cell electrodes. This capacitor therefore controls the change in the resonant frequency.

The value of a capacitor is determined by the relationship shown in Equation 2.

$$C = kA\varepsilon/d \quad (\text{Equation 2})$$

where k = proportional constant (different from Equation 1)
 A = area of smaller plate
 d = distance between plates
 ε = effective dielectric constant

The key to the functioning of the FORTÉ system is the change in the effective dielectric constant of the bale when it is measured at the two different heights. This change or difference in the dielectric constant causes a change in the resonant frequency. The difference between the measured frequency of the upper reading and the lower reading is referred to as the "FORTÉ Number" or "FORTÉ Reading".

10.2. PRACTICAL APPLICATION

The “FORTÉ Number” is the “Reference Frequency” minus the “Product Frequency”.

Items that are at a normal target weight and moisture will have approximately the same FORTÉ Number.

A FORTÉ Number larger than the nominal number indicates an item with higher moisture.

A FORTÉ Number smaller than the nominal number indicates an item with lower moisture.

Calibration is the process of determining the correlation between the Forte Numbers, item weights, and the laboratory moisture measurements.

11. SERVICE

If a problem occurs and service is required, please contact us with full details, and symptoms of the malfunction:

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