5.1.1 DESCRIPTION

Any measured value can be displayed on demand using the ACTUAL key. Each time the ACTUAL key is pressed, the beginning of a new page of monitored values is displayed. These are grouped as: A1 METERING, A2 STATUS, A3 POWER ANALYSIS, A4 PRODUCT INFO. Use the MESSAGE ▲ and MESSAGE ▼ keys to move between actual value messages. A detailed description of each displayed message in these groups is given in the sections that follow.

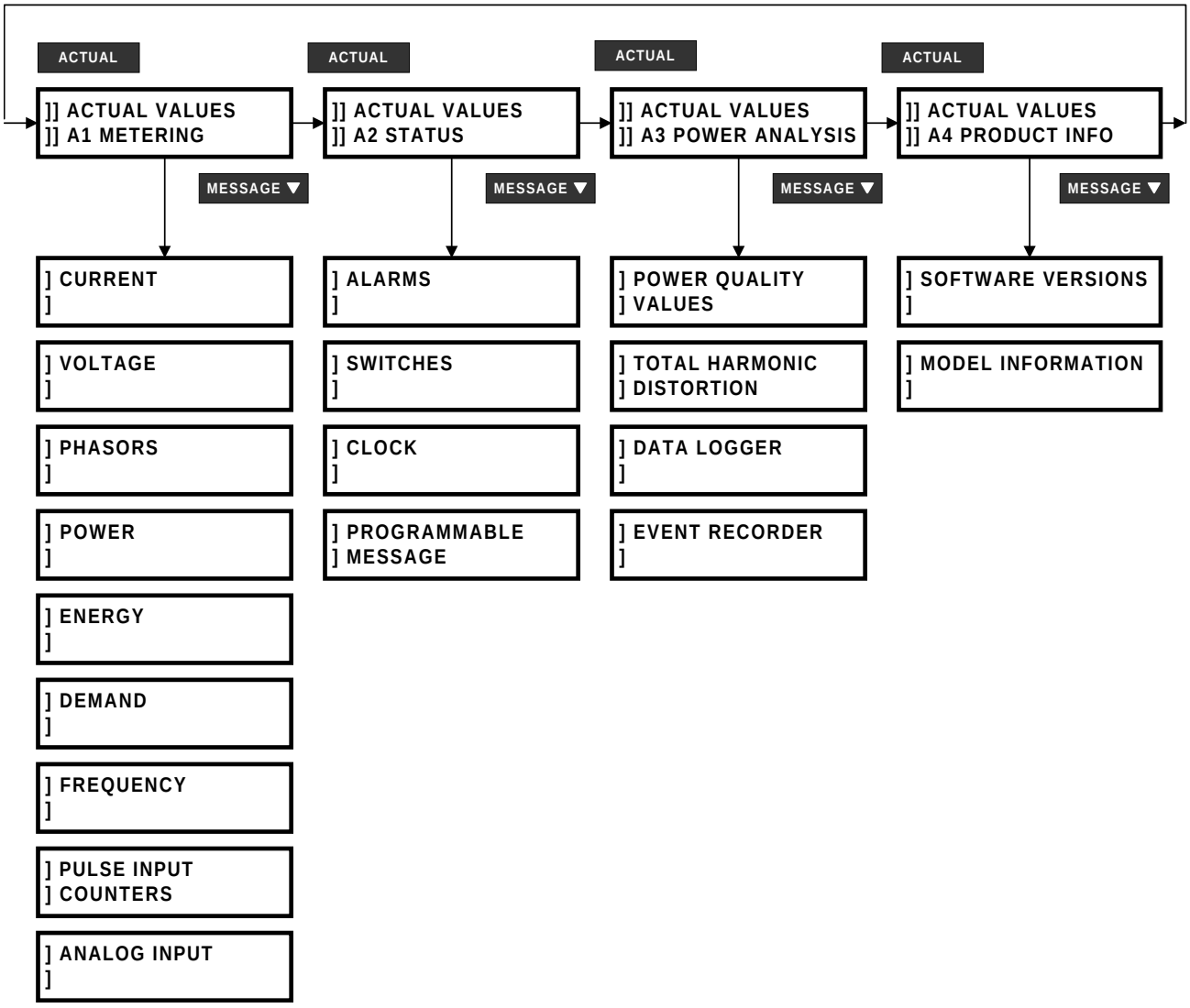


Figure 5–1: ACTUAL VALUES MESSAGE ORGANIZATION

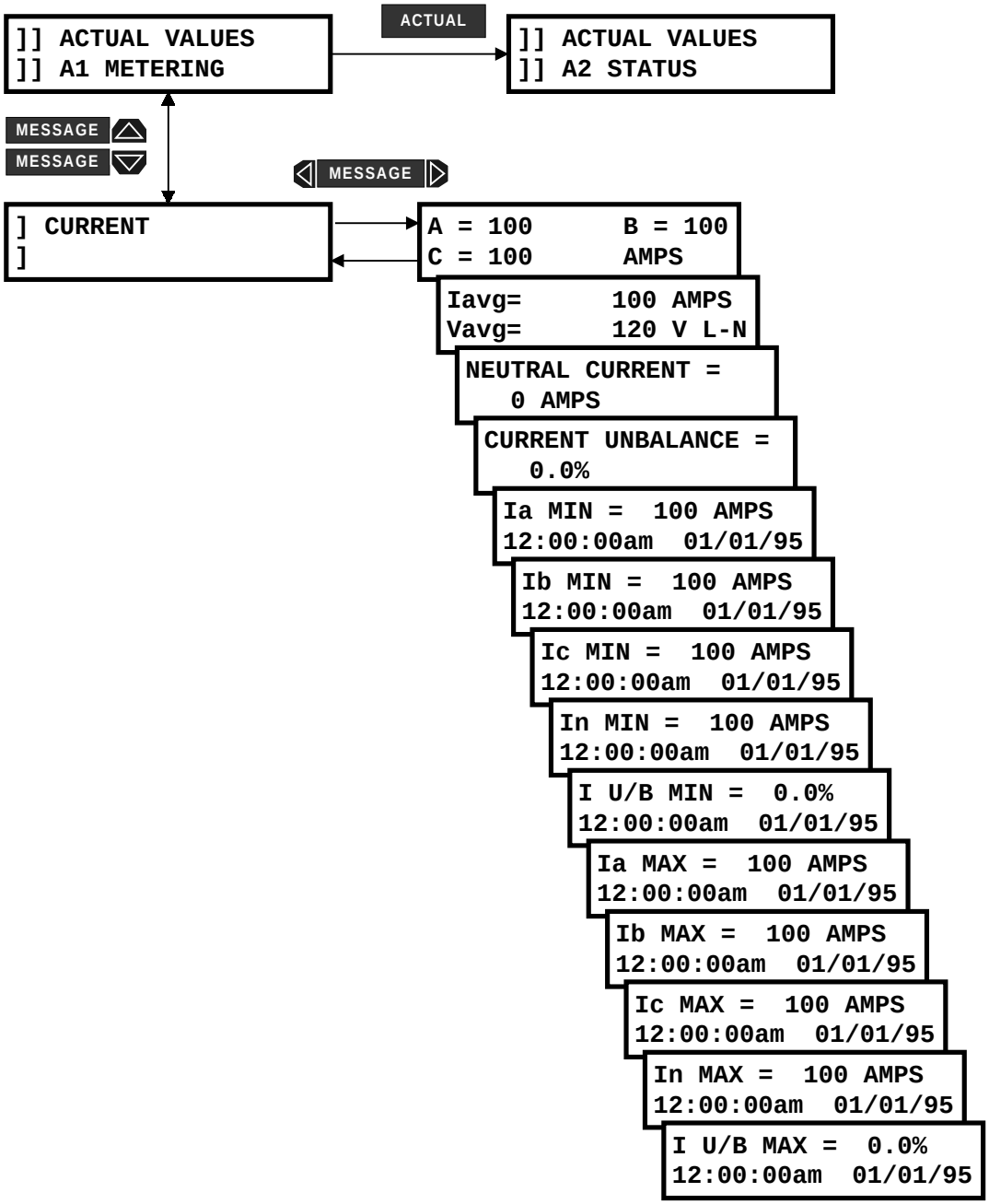


Figure 5–2: ACTUAL VALUES – METERING / CURRENT

A: B: C: CURRENT: Displays the current in each phase corresponding to the A, B, and C phase inputs. Current will be measured correctly only if the **CT PRIMARY** is entered to match the installed CT primary and the CT secondary is wired to match the 1 or 5 A input. If the displayed current does not match the actual current, check this setpoint and wiring.

Iavg/Vavg: Displays the average of the three phase currents and three voltages is displayed in this message. This line is not visible if the **VT WIRING** setpoint is set to SINGLE PHASE DIRECT. L-N is displayed when **VT WIRING** is set to 4 WIRE WYE (3 VTs), 4 WIRE WYE DIRECT, 4 WIRE WYE (2 VTs), or 3 WIRE DIRECT. L-L is displayed when **VT WIRING** is set to 3 WIRE DELTA (2 VTs).

NEUTRAL CURRENT: Neutral current can be determined by two methods. One method measures the current via the neutral CT input. The second calculates the neutral current based on the three phase currents; using the instantaneous samples, $I_a + I_b + I_c = I_n$. If the sum of the phase currents does not equal 0, the result is the neutral current. When using the CT input, the neutral current reading will be correct only if the CT is wired correctly and the correct neutral CT primary value is entered. Verify neutral current by connecting a clamp-on ammeter around all 3 phases. If the neutral current appears incorrect, check the settings in **S2 SYSTEM SETUP** \ **CURRENT/VOLTAGE CONFIGURATION** and verify the CT wiring.

CURRENT UNBALANCE: Displays the percentage of current unbalance. Current unbalance is calculated as:

$$\frac{|I_m - I_{av}|}{I_{av}} \times 100\%$$

where: I_{av} = *average phase current* = $(I_a + I_b + I_c) / 3$
I_m = current in phase with maximum deviation from I_{av},

NOTE

Even though it is possible to achieve unbalance greater than 100% with the above formula, the PQM limits unbalance readings to 100%.

If the average current is below 10% of the **CT PRIMARY** setpoint, the unbalance reading is forced to 0%. This avoids nuisance alarms when the system is lightly loaded. If the simulation currents are being used, the unbalance is never forced to 0%.

Ia, Ib, Ic, In MINIMUM: Displays the minimum current magnitudes and the time and date of their occurrence. This information is stored in non-volatile memory and is retained during loss of control power. The **S1 PQM SETUP** \ **CLEAR DATA** \ **CLEAR MIN/MAX CURRENT VALUES** setpoint clears these values.

I U/B MINIMUM: Displays the minimum current unbalance and the time and date of its measurement. This information is stored in non-volatile memory and is retained during loss of control power. The **S1 PQM SETUP** \ **CLEAR DATA** \ **CLEAR MIN/MAX CURRENT VALUES** setpoint clears this value.

Ia, Ib, Ic, In MAXIMUM: Displays the maximum current magnitudes and the time and date of their occurrence. This information is stored in non-volatile memory and is retained during loss of control power. The **S1 PQM SETUP** \ **CLEAR DATA** \ **CLEAR MIN/MAX CURRENT VALUES** setpoint clears these values.

I U/B MAXIMUM: Displays the maximum current unbalance and the time and date of its measurement. This information is stored in non-volatile memory and is retained during loss of control power. The **S1 PQM SETUP** \ **CLEAR DATA** \ **CLEAR MIN/MAX CURRENT VALUES** setpoint command clears this value.

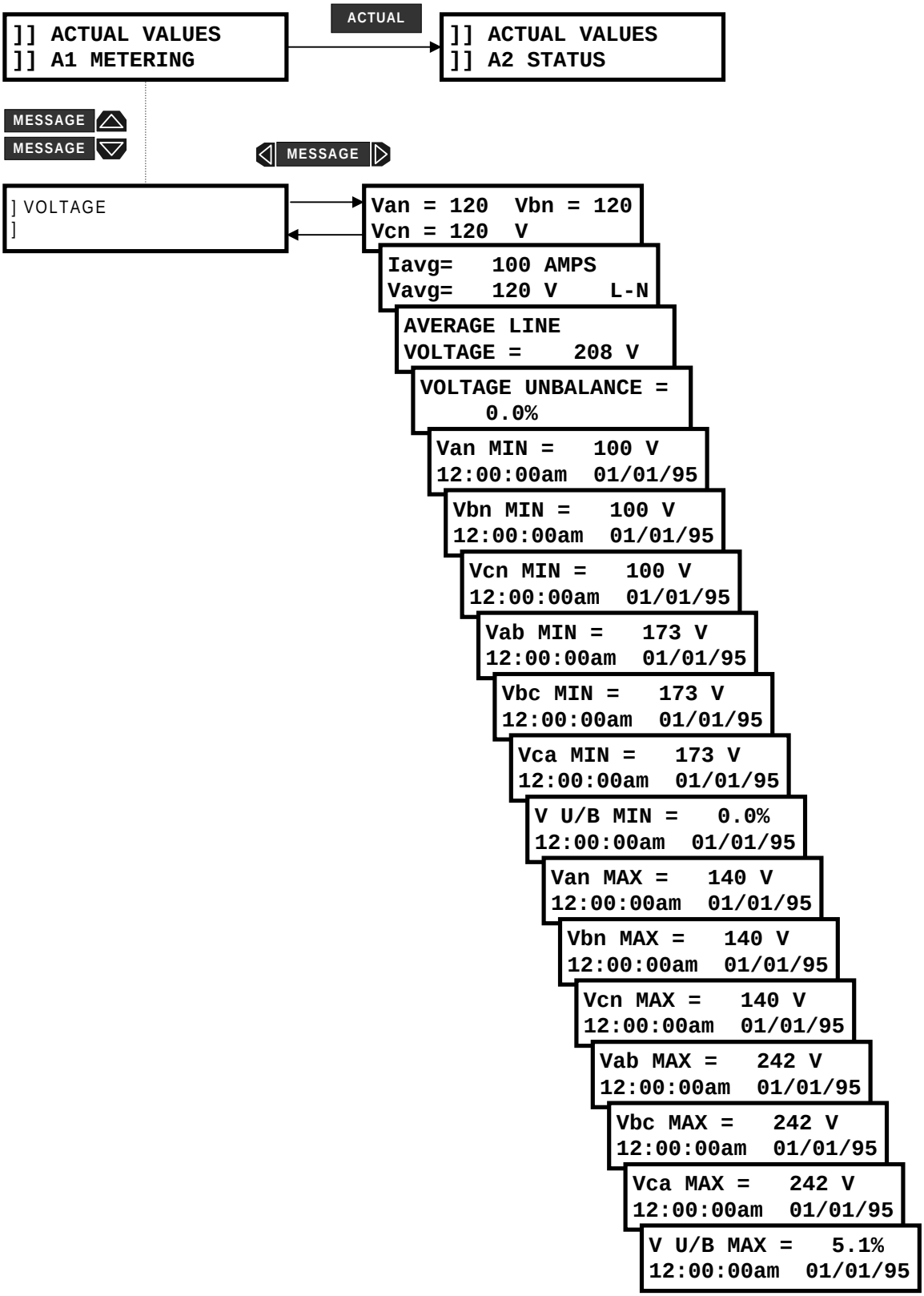


Figure 5–3: ACTUAL VALUES PAGE 1 – METERING / VOLTAGE

Van, Vbn, Vcn, VOLTAGE: Displays each phase voltage corresponding to the A, B, and C voltage inputs. This voltage will be measured correctly only if the **VT RATIO**, **VT NOMINAL SECONDARY**, and **VOLTAGE WIRING** setpoint values match the installed VTs. If the displayed voltage does not match the actual voltage, check the setpoints and wiring. This message appears only if the **VT WIRING** is configured for a wye input.

Iavg/Vavg: Displays the average of the three phase currents/voltages. This value is not visible if the **VT WIRING** setpoint is set to SINGLE PHASE DIRECT. L-N is displayed when **VT WIRING** is set to 4 WIRE WYE (3 VTs), 4 WIRE WYE DIRECT, 4 WIRE WYE (2 VTs), or 3 WIRE DIRECT and L-L is displayed when **VT WIRING** is set to 3 WIRE DELTA (2 VTs).

Vab, Vbc, Vca, VOLTAGE: Displays each line voltage corresponding to the A, B, and C voltage inputs. The measured voltage is correct only if the **VT RATIO**, **VT NOMINAL SECONDARY**, and **VOLTAGE WIRING** setpoints match the installed VTs. If the displayed voltage does not match the actual voltage, check the setpoints and wiring.

AVERAGE LINE VOLTAGE: Displays the average of the three line voltages. This value is not visible if the **VT WIRING** setpoint is set to SINGLE PHASE DIRECT.

VOLTAGE UNBALANCE: Displays the percentage voltage unbalance. Voltage unbalance is calculated as shown below. If the **VOLTAGE WIRING** is configured for a WYE input, voltage unbalance is calculated using phase quantities. If the **VT WIRING** is configured as a DELTA input, voltage unbalance is calculated using line voltages.

$$\frac{|V_m - V_{av}|}{V_{av}} \times 100\%$$

where: V_{av} = average phase voltage = ($V_{an} + V_{bn} + V_{cn}$) / 3 for WYE and 3 WIRE DIRECT connections
= average line voltage ($V_{ab} + V_{bc} + V_{ca}$) / 3 for 3 WIRE DELTA/2 VTs connection
V_m = voltage in a phase (or line) with maximum deviation from V_{av}

NOTE

Even though it is possible to achieve unbalance greater than 100% with the above formula, the PQM will limit unbalance readings to 100%.

If the average voltage is below 10% of **VT RATIO** × **VT NOMINAL SECONDARY VOLTAGE** for 3 WIRE DELTA/2 VTs, 4 WIRE WYE/3 VTs, and 4 WIRE WYE/2 VTs connections, or below 10% of **VT RATIO** × **NOMINAL DIRECT INPUT VOLTAGE** for 4 WIRE WYE/DIRECT and 3 WIRE DIRECT connections, the unbalance reading is forced to 0%. This is implemented to avoid nuisance alarms when the system is lightly loaded. If the simulation voltages are being used, the unbalance is never forced to 0%.

Van, Vbn, Vcn MINIMUM: Displays the minimum phase voltage magnitudes and the time and date of their occurrence. This information is stored in non-volatile memory and is retained during loss of control power. The **S1 PQM SETUP** \ **CLEAR DATA** \ **CLEAR MIN/MAX VOLTAGE VALUES** setpoint clears these values.

Vab, Vbc, Vca MINIMUM: Displays the minimum line voltage magnitudes and the time and date of their occurrence. This information is stored in non-volatile memory and is retained during loss of control power. The **S1 PQM SETUP** \ **CLEAR DATA** \ **CLEAR MIN/MAX VOLTAGE VALUES** setpoint clears these values.

V U/B MINIMUM: Displays minimum voltage unbalance and the time and date of its measurement. This information is stored in non-volatile memory and is retained during loss of control power. This value is cleared with the **S1 PQM SETUP** \ **CLEAR DATA** \ **CLEAR MIN/MAX VOLTAGE VALUES** setpoint.

Van, Vbn, Vcn MAXIMUM: Displays the maximum phase voltage magnitudes and the time and date of their occurrence. This information is stored in non-volatile memory and is retained during loss of control power. The **S1 PQM SETUP** \ **CLEAR DATA** \ **CLEAR MIN/MAX VOLTAGE VALUES** setpoint clears these values.

Vab, Vbc, Vca MAXIMUM: Displays the maximum line voltage magnitudes and the time and date of their occurrence. This information is stored in non-volatile memory and is retained during loss of control power. The **S1 PQM SETUP** \ **CLEAR DATA** \ **CLEAR MIN/MAX VOLTAGE VALUES** setpoint clears these values.

V U/B MAXIMUM: Displays the maximum voltage unbalance and the time and date of its measurement. This information is stored in non-volatile memory and is retained during loss of control power. The value is cleared with the **S1 PQM SETUP** \ **CLEAR DATA** \ **CLEAR MIN/MAX VOLTAGE VALUES** setpoint.

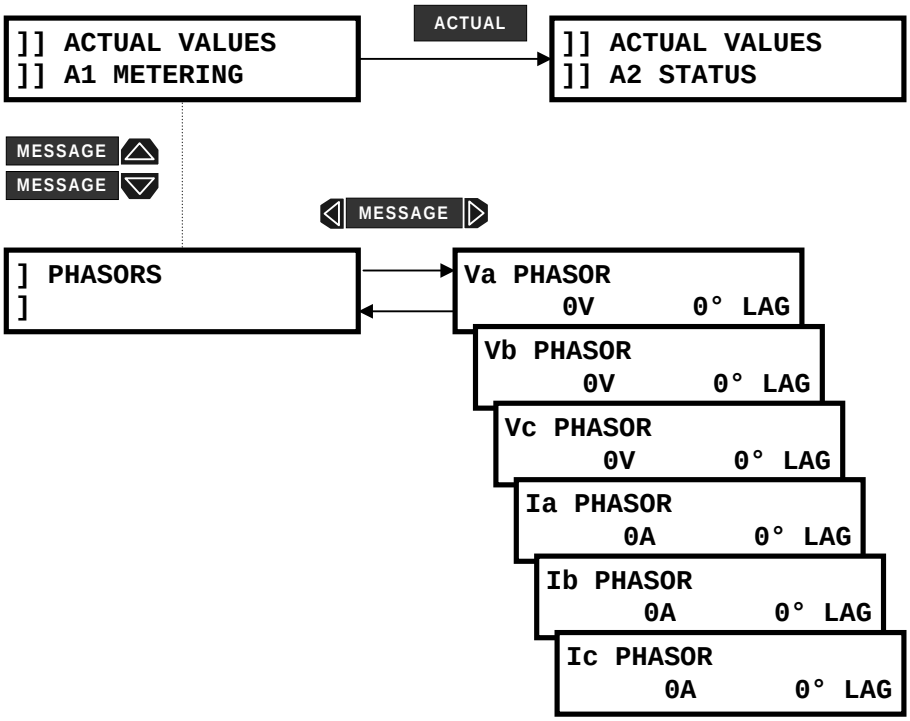


Figure 5–4: ACTUAL VALUES PAGE 1 – METERING/PHASORS

Va PHASOR: Displays a phasor representation for the magnitude and angle of Va. Va is used as a reference for all other phasor angles. If there is no voltage present at the PQM voltage inputs, then Ia will be used as the reference for all other angles. Va is also used as the reference when in Simulation Mode.

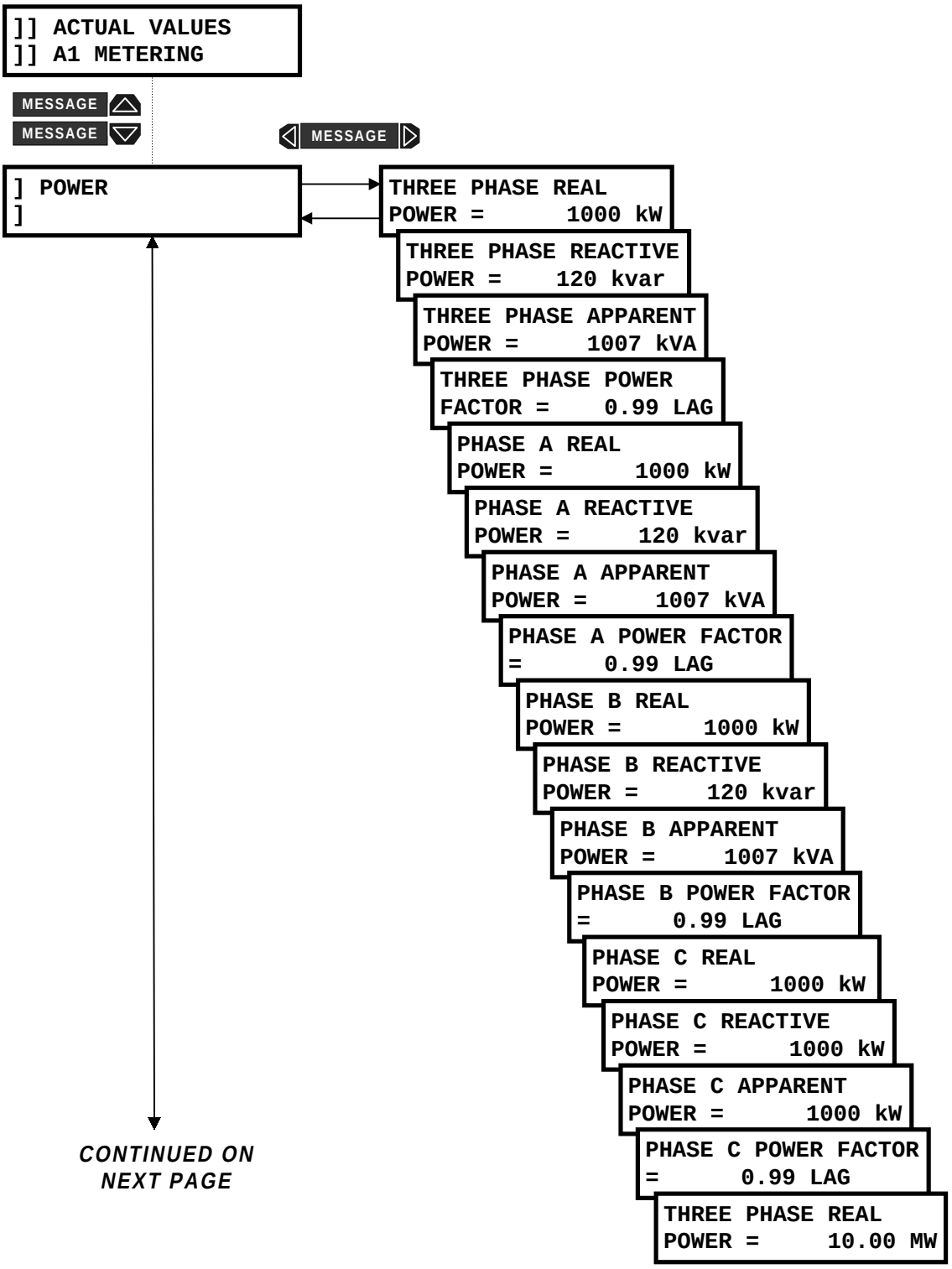
Vb PHASOR: Displays a phasor representation for the magnitude and angle of Vb. Vb uses the angle of Va as a reference point. If there is no voltage at the PQM voltage inputs, Ia is used as the reference. Vb is not displayed when the PQM is configured for the 3 WIRE DELTA/2 VTs, 4 WIRE WYE/2 VTs, or SINGLE PHASE DIRECT connections.

Vc PHASOR: A phasor representation for the magnitude and angle of Vc is displayed here. Vc uses the angle of Va as a reference point. If there is no voltage at the PQM voltage inputs, Ia is used as the reference. Vc is not displayed when the PQM is configured for SINGLE PHASE DIRECT connection.

Ia PHASOR: A phasor representation for the magnitude and angle of Ia is displayed here. Ia is used as a reference for all other Phasor angles only when there is no voltage present at the PQM voltage inputs, otherwise, Va is used as the reference.

Ib PHASOR: A phasor representation for the magnitude and angle of Ib is displayed here. Ib uses the angle of Va as a reference point. If there is no voltage at the PQM voltage inputs, Ia is used as the reference. Ib is not displayed when the PQM is configured for SINGLE PHASE DIRECT connection.

Ic PHASOR: A phasor representation for the magnitude and angle of Ic is displayed here. Ic is uses the angle of Va as a reference point. If there is no voltage at the PQM voltage inputs, Ia is used as the reference. Ic is not displayed when the PQM is configured for SINGLE PHASE DIRECT connection.


]] ACTUAL VALUES
]] A1 METERING
MESSAGE
MESSAGE
MESSAGE
] POWER
]
THREE PHASE REAL POWER = 1000 kW
THREE PHASE REACTIVE POWER = 120 kvar
THREE PHASE APPARENT POWER = 1007 kVA
THREE PHASE POWER FACTOR = 0.99 LAG
PHASE A REAL POWER = 1000 kW
PHASE A REACTIVE POWER = 120 kvar
PHASE A APPARENT POWER = 1007 kVA
PHASE A POWER FACTOR = 0.99 LAG
PHASE B REAL POWER = 1000 kW
PHASE B REACTIVE POWER = 120 kvar
PHASE B APPARENT POWER = 1007 kVA
PHASE B POWER FACTOR = 0.99 LAG
PHASE C REAL POWER = 1000 kW
PHASE C REACTIVE POWER = 1000 kW
PHASE C APPARENT POWER = 1000 kW
PHASE C POWER FACTOR = 0.99 LAG
THREE PHASE REAL POWER = 10.00 MW
CONTINUED ON NEXT PAGE

CONTINUED FROM PREVIOUS PAGE

MESSAGE

MESSAGE

THREE PHASE REACTIVE POWER = 1.20 Mvar

THREE PHASE APPARENT POWER = 10.07 MVA

3Φ kW MIN = 1000
12:00:00am 01/01/95

3Φ kvar MIN = 120
12:00:00am 01/01/95

3Φ kVA MIN = 1007
12:00:00am 01/01/95

3Φ PF MIN = 0.99 LAG
12:00:00am 01/01/95

3Φ kW MAX = 1000
12:00:00am 01/01/95

3Φ kvar MAX = 120
12:00:00am 01/01/95

3Φ PF MAX = 0.99 LAG
12:00:00am 01/01/95

AΦ kW MIN = 1000
12:00:00am 01/01/95

AΦ kvar MIN = 120
12:00:00am 01/01/95

AΦ kVA MIN = 1007
12:00:00am 01/01/95

AΦ PF MIN = 0.99 LAG
12:00:00am 01/01/95

AΦ kW MAX = 1000
12:00:00am 01/01/95

AΦ kvar MAX = 120
12:00:00am 01/01/95

AΦ kVA MAX = 1007
12:00:00am 01/01/95

AΦ PF MAX = 0.99 LAG
12:00:00am 01/01/95

CONTINUED ON NEXT PAGE

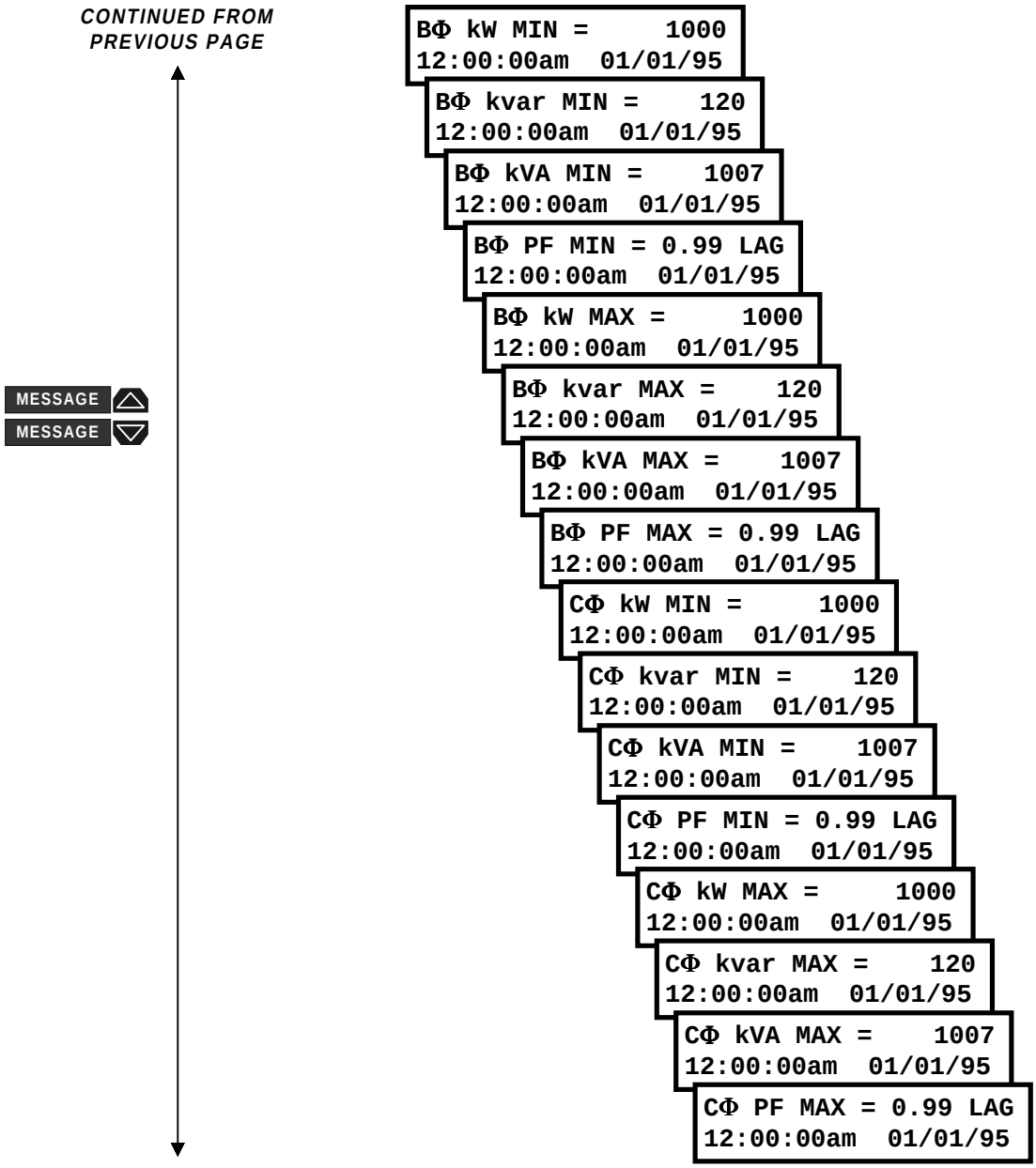


Figure 5–5: ACTUAL VALUES PAGE 1 – METERING/POWER

THREE PHASE/A/B/C REAL POWER: The total RMS three phase real power as well as the individual phase A/B/C real power is displayed in these messages. The phase A/B/C real power messages will be displayed only for a WYE or 3 WIRE DIRECT connected system. The PQM shows direction of flow by displaying the signed value of kW. Refer to Figure 5.6 for the convention used to describe power direction.

THREE PHASE/A/B/C REACTIVE POWER: The total RMS three phase reactive power as well as the individual phase A/B/C reactive power is displayed in these messages. The phase A/B/C reactive power messages will be displayed only for a WYE or 3 WIRE DIRECT connected system. The PQM shows direction of flow by displaying the signed value of kvar. Refer to Figure 5.6 for the convention used to describe power direction.

THREE PHASE/A/B/C APPARENT POWER: The total RMS three phase apparent power as well as the individual phase A/B/C apparent power is displayed in these messages. The phase A/B/C apparent power messages will be displayed only for a WYE or 3 WIRE DIRECT connected system.

THREE PHASE/A/B/C POWER FACTOR: The three phase true power factor as well as the individual phase A/B/C true power factors is displayed in these messages. The phase A/B/C true power factor messages will be displayed only for a WYE or 3 WIRE DIRECT connected system.

THREE PHASE/A/B/C kW MINIMUM: The minimum three phase real power as well as the minimum individual phase A/B/C real power is displayed in these messages. The time and date at which these minimum values were measured is also displayed in these messages. This information is stored in non-volatile memory and will be retained during a loss of control power. The phase A/B/C minimum real power messages will be displayed only for a WYE connected system. The setpoint **S1 PQM SETUP \ CLEAR DATA \ CLEAR MIN/MAX POWER VALUES** is used to clear these values.

THREE PHASE/A/B/C kvar MINIMUM: The minimum three phase reactive power as well as the minimum individual phase A/B/C reactive power is displayed in these messages. The time and date at which these minimum values were measured is also displayed in these messages. This information is stored in non-volatile memory and will be retained during a loss of control power. The phase A/B/C minimum reactive power messages will be displayed only for a WYE connected system. The setpoint **S1 PQM SETUP \ CLEAR DATA \ CLEAR MIN/MAX POWER VALUES** is used to clear these values.

THREE PHASE/A/B/C kVA MINIMUM: The minimum three phase apparent power as well as the minimum individual phase A/B/C apparent power is displayed in these messages. The time and date at which these minimum values were measured is also displayed in these messages. This information is stored in non-volatile memory and will be retained during a loss of control power. The phase A/B/C minimum apparent power messages will be displayed only for a WYE connected system. The setpoint **S1 PQM SETUP \ CLEAR DATA \ CLEAR MIN/MAX POWER VALUES** is used to clear these values.

THREE PHASE/A/B/C PF MINIMUM: The minimum three phase lead or lag power factor as well as the minimum lead or lag individual phase A/B/C power factor is displayed in these messages. The time and date at which these minimum values were measured is also displayed in these messages. This information is stored in non-volatile memory and will be retained during a loss of control power. The phase A/B/C minimum lead or lag power factor messages will be displayed only for a WYE connected system. The setpoint **S1 PQM SETUP \ CLEAR DATA \ CLEAR MIN/MAX POWER VALUES** is used to clear these values.

THREE PHASE/A/B/C kW MAXIMUM: The maximum three phase real power as well as the maximum individual phase A/B/C real power is displayed in these messages. The time and date at which these maximum values were measured is also displayed in these messages. This information is stored in non-volatile memory and will be retained during a loss of control power. The phase A/B/C maximum real power messages will be displayed only for a WYE connected system. The setpoint **S1 PQM SETUP \ CLEAR DATA \ CLEAR MIN/MAX POWER VALUES** is used to clear these values.

THREE PHASE/A/B/C kvar MAXIMUM: The maximum three phase reactive power as well as the maximum individual phase A/B/C reactive power is displayed in these messages. The time and date at which these maximum values were measured is also displayed in these messages. This information is stored in non-volatile

memory and will be retained during a loss of control power. The phase A/B/C maximum reactive power messages will be displayed only for a WYE connected system. The setpoint **S1 PQM SETUP \ CLEAR DATA \ CLEAR MIN/MAX POWER VALUES** is used to clear these values.

THREE PHASE/A/B/C kVA MAXIMUM: The maximum three phase apparent power as well as the maximum individual phase A/B/C apparent power is displayed in these messages. The time and date at which these maximum values were measured is also displayed in these messages. This information is stored in non-volatile memory and will be retained during a loss of control power. The phase A/B/C maximum apparent power messages will be displayed only for a WYE connected system. The setpoint **S1 PQM SETUP \ CLEAR DATA \ CLEAR MIN/MAX POWER VALUES** is used to clear these values.

THREE PHASE/A/B/C PF MAXIMUM: The maximum three phase lead or lag power factor as well as the maximum lead or lag individual phase A/B/C power factor is displayed in these messages. The time and date at which these maximum values were measured is also displayed in these messages. This information is stored in non-volatile memory and will be retained during a loss of control power. The phase A/B/C maximum lead or lag power factor messages will be displayed only for a WYE connected system. The setpoint **S1 PQM SETUP \ CLEAR DATA \ CLEAR MIN/MAX POWER VALUES** is used to clear these values.

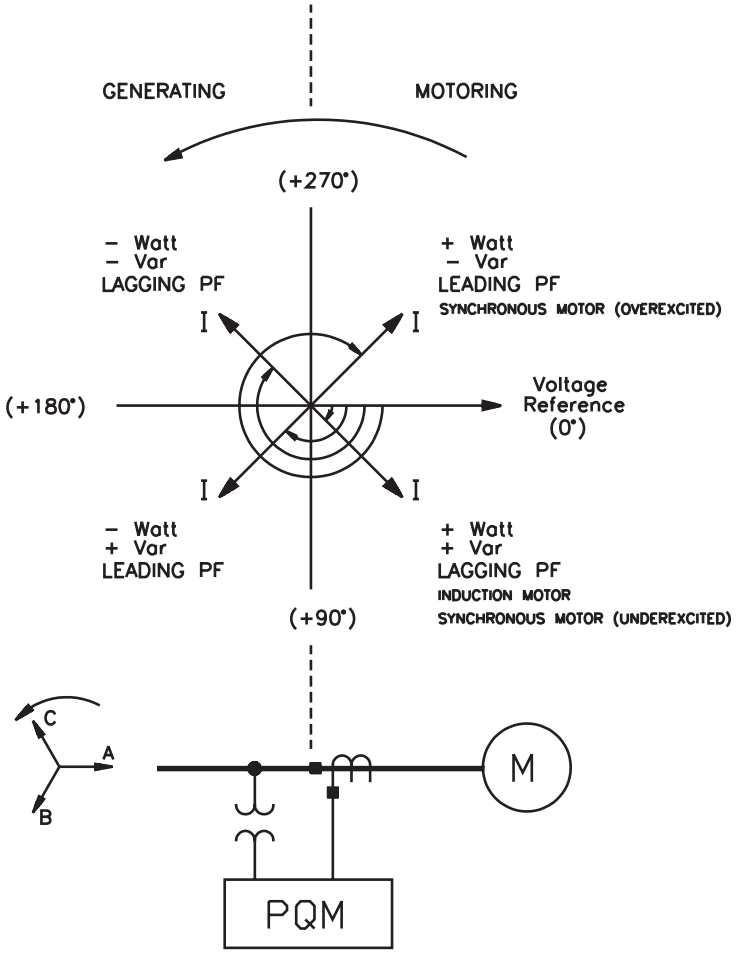


Figure 5–6: POWER MEASUREMENT CONVENTIONS

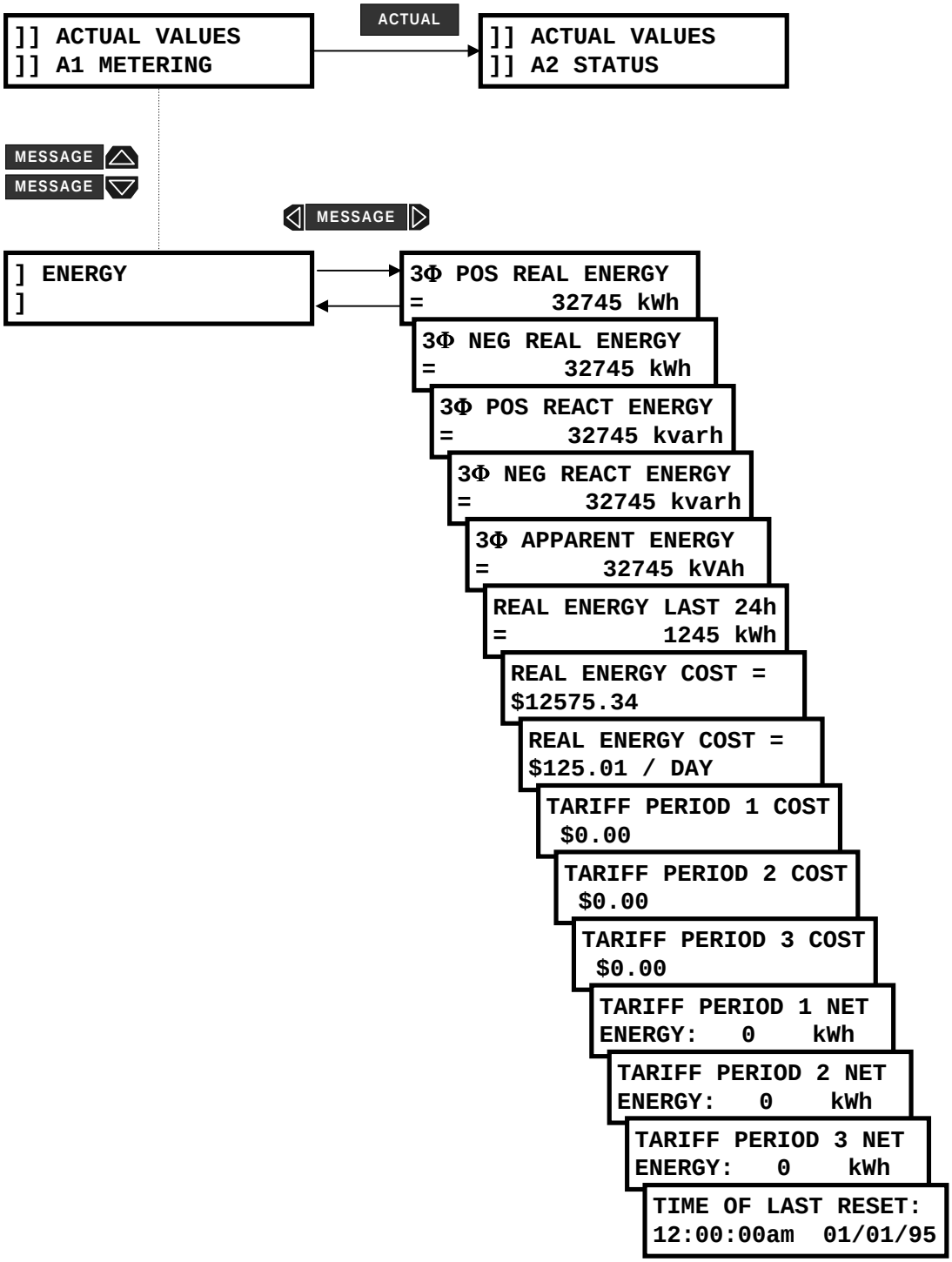


Figure 5–7: ACTUAL VALUES PAGE 1 – METERING / ENERGY

3Φ POS REAL ENERGY: This message displays the positive watthours (in kWh) since the **TIME OF LAST RESET** date. Real power in the positive direction will add to this accumulated value, and real power in the negative direction will add to the negative watthour value. The setpoint **S1 PQM SETUP \ CLEAR DATA \ CLEAR ENERGY VALUES** is used to clear this value. The displayed value rolls over to 0 once the value 4294967295 (FFFFFFFFh) has been reached.

3Φ NEG REAL ENERGY: This message displays the negative watthours (in kWh) since the **TIME OF LAST RESET** date. Real power in the negative direction will add to this accumulated value, and real power in the positive direction will add to the positive watthour value. The setpoint **S1 PQM SETUP \ CLEAR DATA \ CLEAR ENERGY VALUES** is used to clear this value. The displayed value will roll over to 0 once the value 4294967295 (FFFFFFFFh) has been reached.

3Φ POS REACT ENERGY: This message displays the positive varhours (in kvarh) since the **TIME OF LAST RESET** date. Reactive power in the positive direction will add to this accumulated value, and reactive power in the negative direction will add to the negative varhour value. The setpoint **S1 PQM SETUP \ CLEAR DATA \ CLEAR ENERGY VALUES** is used to clear this value. The displayed value will roll over to 0 once the value 4294967295 (FFFFFFFFh) has been reached.

3Φ NEG REACT ENERGY: This message displays the negative varhours (in kvarh) since the **TIME OF LAST RESET** date. Reactive power in the negative direction will add to this accumulated value, and reactive power in the positive direction will add to the positive varhour value. The **S1 PQM SETUP \ CLEAR DATA \ CLEAR ENERGY VALUES** setpoint clears this value. The displayed value will roll over to 0 once the value 4294967295 (FFFFFFFFh) has been reached.

3Φ APPARENT ENERGY: This message displays the accumulated VAhours (in kVAh) since the TIME OF LAST RESET date. The setpoint **S1 PQM SETUP \ CLEAR DATA \ CLEAR ENERGY VALUES** clears this value. The displayed value will roll over to 0 once the value 4294967295 (FFFFFFFFh) has been reached.

REAL ENERGY LAST 24h: This message displays the accumulated real energy (in kWh) over the last 24-hour period. The 24-hour period used by the PQM is started when control power is applied. The PQM updates this value every hour based on the previous 24-hour period. This information will be lost if control power to the PQM is removed.

REAL ENERGY COST: This message displays the total cost for the real energy accumulated since the **TIME OF LAST RESET** date. The setpoint **S1 PQM SETUP \ CLEAR DATA \ CLEAR ENERGY VALUES** clears this value.

REAL ENERGY COST PER DAY: This message displays the average cost of real energy per day from time of last reset to the present day. The cost per kWh is entered in the **S1 PQM SETUP \ CALCULATION PARAMETERS \ ENERGY COST PER KWH** setpoint.

TARIFF PERIOD 1/2/3 COST: These messages display the cost accrued for the three user-definable tariff periods. The start time and cost per MWh for these tariff periods are entered with the **S1 PQM SETUP \ CALCULATION PARAMETERS \ TARIFF PERIOD 1/2/3 START TIME** and the **S1 PQM SETUP \ CALCULATION PARAMETERS \ TARIFF PERIOD 1/2/3 COST PER MWH** setpoints, respectively.

TARIFF PERIOD 1/2/3 NET ENERGY: These messages display the net energy for the three user-definable tariff periods. The start time and cost per MWh for these tariff periods are entered with the **S1 PQM SETUP \ CALCULATION PARAMETERS \ TARIFF PERIOD 1/2/3 START TIME** and the **S1 PQM SETUP \ CALCULATION PARAMETERS \ TARIFF PERIOD 1/2/3 COST PER MWH** setpoints, respectively.

TIME OF LAST RESET: This message displays the time and date when the energy parameters were last cleared. The setpoint **S1 PQM SETUP \ CLEAR DATA \ CLEAR ENERGY VALUES** clears the energy values.

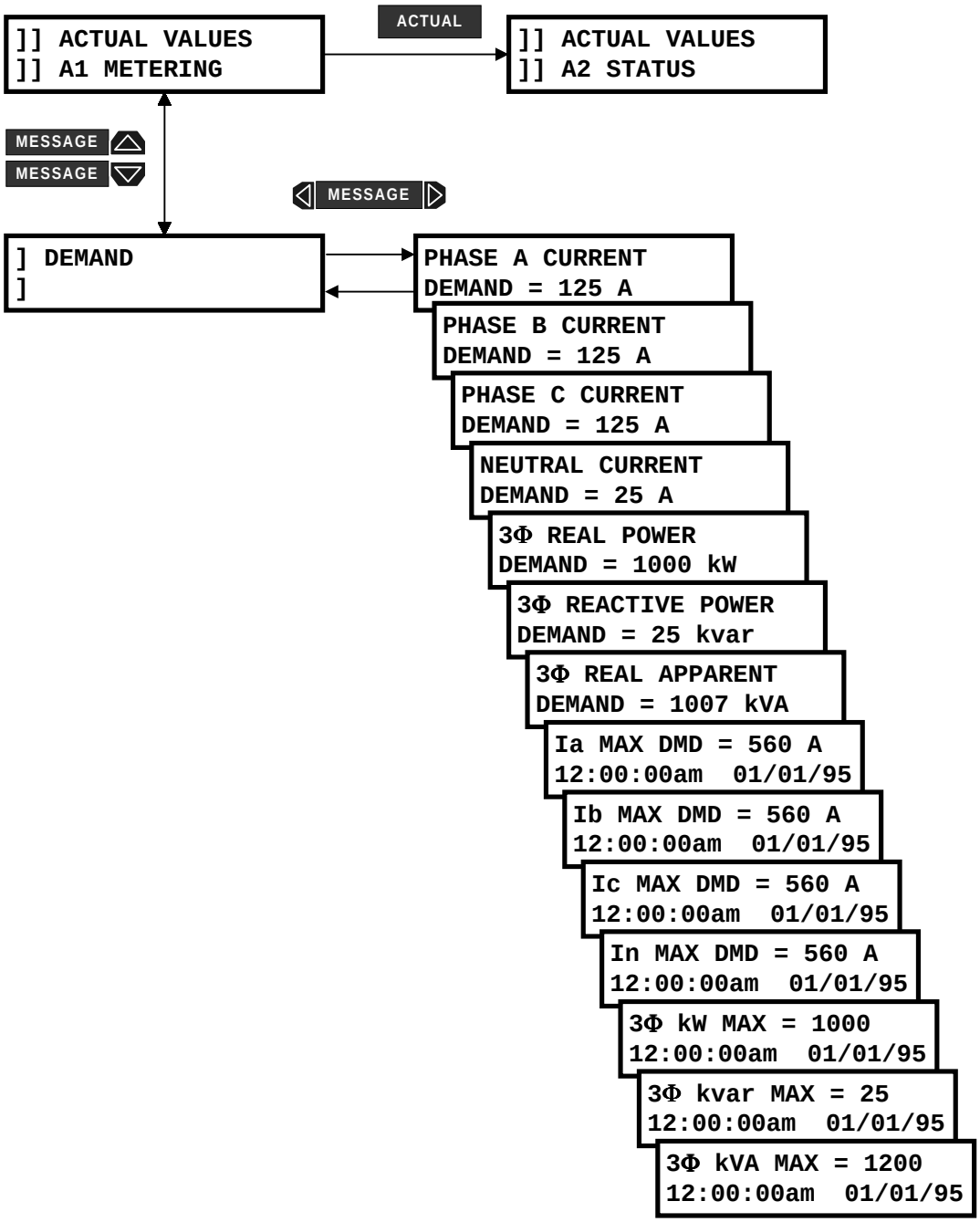


Figure 5–8: ACTUAL VALUES PAGE 1 – METERING / DEMAND

PHASE A/B/C/NEUTRAL DEMAND: This message displays the phase A/B/C/N current demand (in Amps) over the most recent time interval.

3Φ REAL POWER DEMAND: This message displays the 3 phase real power demand (in kW) over the most recent time interval.

3Φ REACTIVE POWER DEMAND: This message displays the 3 phase reactive power demand (in kvar) over the most recent time interval.

3Φ APPARENT POWER DEMAND: This message displays the 3 phase apparent power demand (in kVA) over the most recent time interval.

A/B/C/N CURRENT MAX DEMAND: This message displays the maximum phase A/B/C/N current demand (in Amps) and the time and date when this occurred. The setpoint **S1 PQM SETUP \ CLEAR DATA \ CLEAR MAX DEMAND VALUES** is used to clear this value.

3Φ kW MAX: This message displays the maximum three-phase real power demand (in kW) and the time and date when this occurred. The setpoint **S1 PQM SETUP \ CLEAR DATA \ CLEAR MAX DEMAND VALUES** clears this value.

3Φ kvar MAX: This message displays the maximum 3 phase reactive power demand (in kvar) and the time and date when this occurred. The setpoint **S1 PQM SETUP \ CLEAR DATA \ CLEAR MAX DEMAND VALUES** is used to clear this value.

3Φ kVA MAX: This message displays the maximum 3 phase apparent power demand (in kVA) and the time and date when this occurred. The setpoint **S1 PQM SETUP\CLEAR DATA\CLEAR MAX DEMAND VALUES** is used to clear this value.

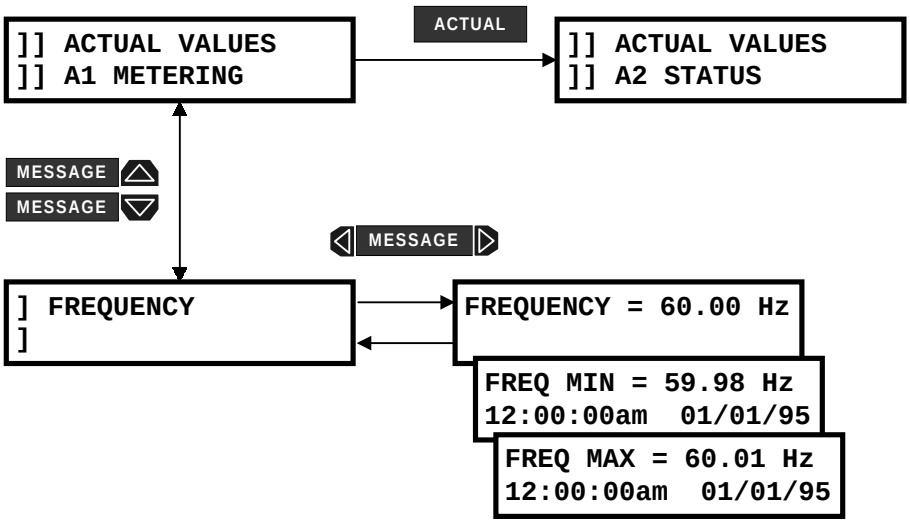


Figure 5–9: ACTUAL VALUES PAGE 1 – METERING / FREQUENCY

FREQUENCY: This message displays the frequency (in Hz). Frequency is calculated from the phase A-N voltage (when setpoint **S2 SYSTEM SETUP \ CURRENT/VOLTAGE CONFIGURATION \ VT WIRING** is WYE) or from phase A-B voltage (when setpoint **S2 SYSTEM SETUP \ CURRENT/VOLTAGE CONFIGURATION \ VT WIRING** is DELTA). A value of 0.00 is displayed if there is insufficient voltage applied to the PQM's terminals (less than 30 V on phase A).

FREQUENCY MIN: This message displays the minimum frequency measured as well as the time and date at which the minimum frequency occurred. The **S1 PQM SETUP \ CLEAR DATA \ CLEAR MIN/MAX FREQUENCY VALUES** setpoint clears these values.

FREQUENCY MAX: This message displays the maximum frequency measured as well as the time and date at which the maximum frequency occurred. The **S1 PQM SETUP \ CLEAR DATA \ CLEAR MIN/MAX FREQUENCY VALUES** setpoint clears these values.

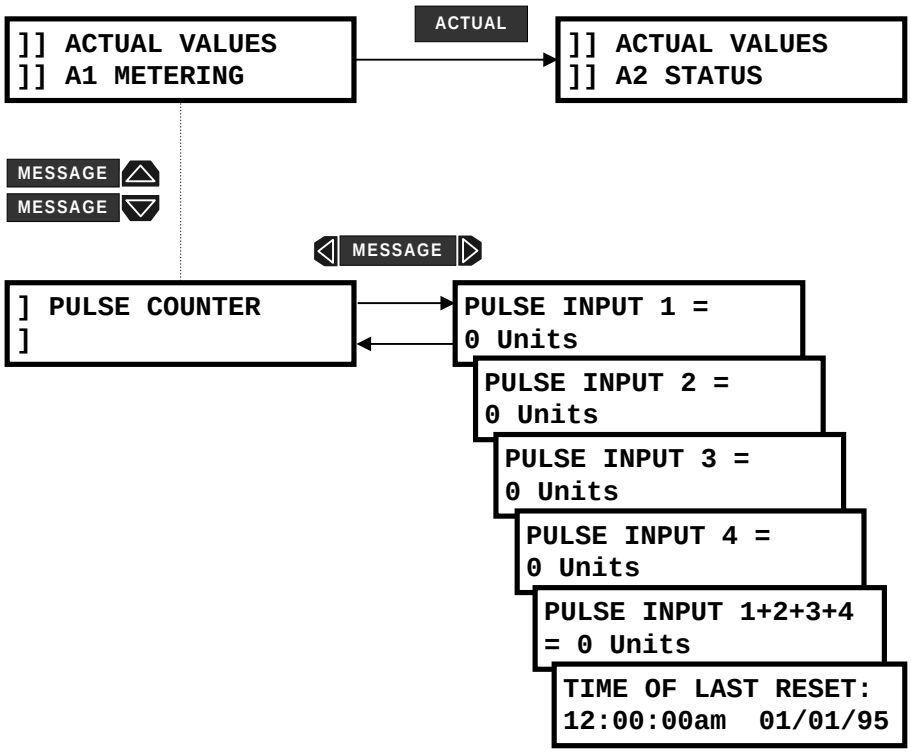


Figure 5–10: ACTUAL VALUES PAGE 1 – METERING / PULSE COUNTER

PULSE INPUT 1: This message displays the accumulated value based on total number of pulses counted since the last reset. One switch input pulse is equal to the value assigned in the **S2 SYSTEM SETUP \ PULSE INPUT \ PULSE INPUT 1 VALUE** setpoint. The units shown after the value are as defined in the **S2 SYSTEM SETUP \ PULSE INPUT \ PULSE INPUT UNITS** setpoint. The displayed value will roll over to 0 once the value 4294967295 (FFFFFFFFh) has been reached. To use this feature, the "C" (control) option must be installed and one of the PQM switch inputs must be assigned to PULSE INPUT 1 function. The switch input will then count the number of closures or openings depending upon how the switch is configured. See setpoints page **S2 SYSTEM SETUP \ SWITCH INPUT A/B/C/D** for details on programming the switch inputs. The minimum timing requirements are shown below in Figure 5.11.

PULSE INPUT 2: See the **PULSE INPUT 1** description above and replace all references to **PULSE INPUT 1** with **PULSE INPUT 2**.

PULSE INPUT 3: See the **PULSE INPUT 1** description above and replace all references to **PULSE INPUT 1** with **PULSE INPUT 3**.

PULSE INPUT 4: See the **PULSE INPUT 1** description above and replace all references to **PULSE INPUT 1** with **PULSE INPUT 4**.

PULSE IN 1+2+3+4: The totalized pulse input value is displayed here. The pulse inputs totalized is based on the **S2 SYSTEM SETUP \ PULSE INPUT \ PULSE INPUT TOTAL** setpoint.

TIME OF LAST RESET: This message displays the time and date when the pulse input values were last cleared. The **S1 PQM SETUP \ CLEAR DATA \ CLEAR PULSE INPUT VALUES** setpoint clears the pulse input values.

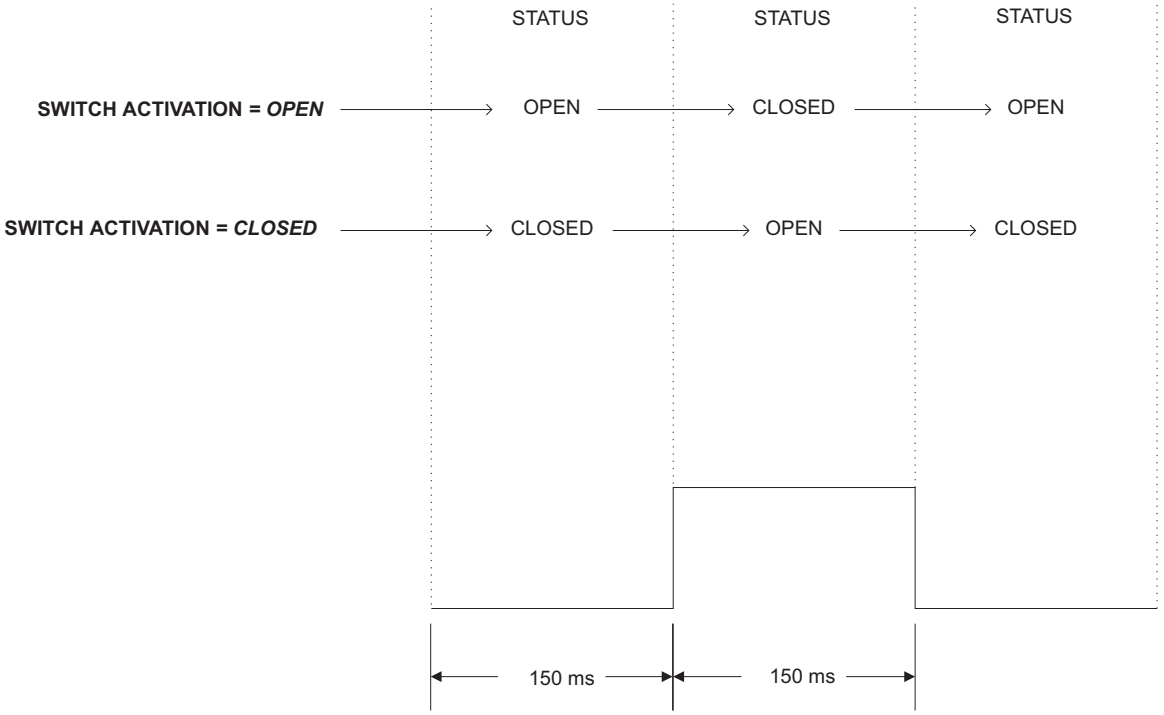


Figure 5–11: PULSE INPUT TIMING

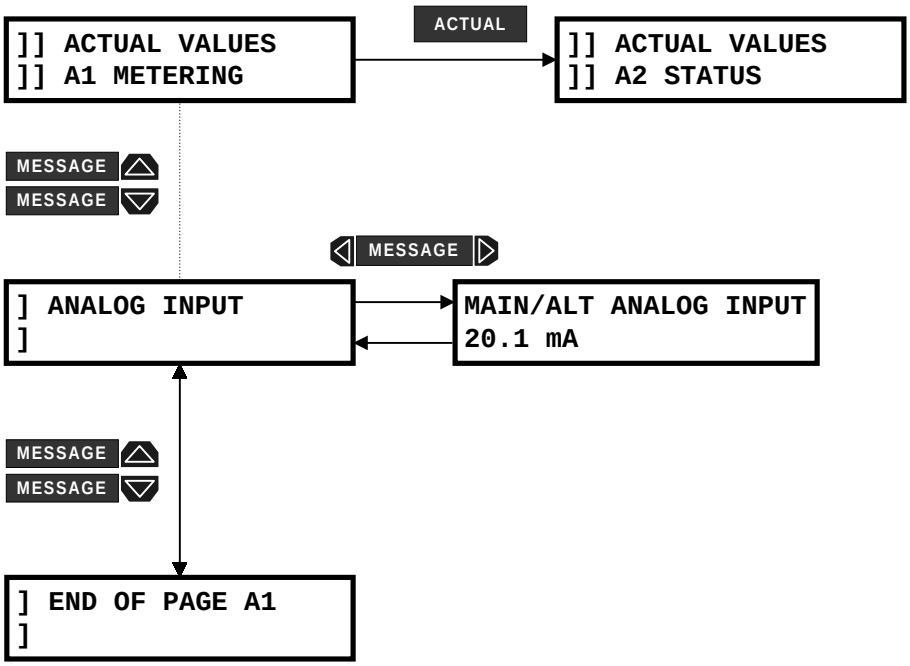
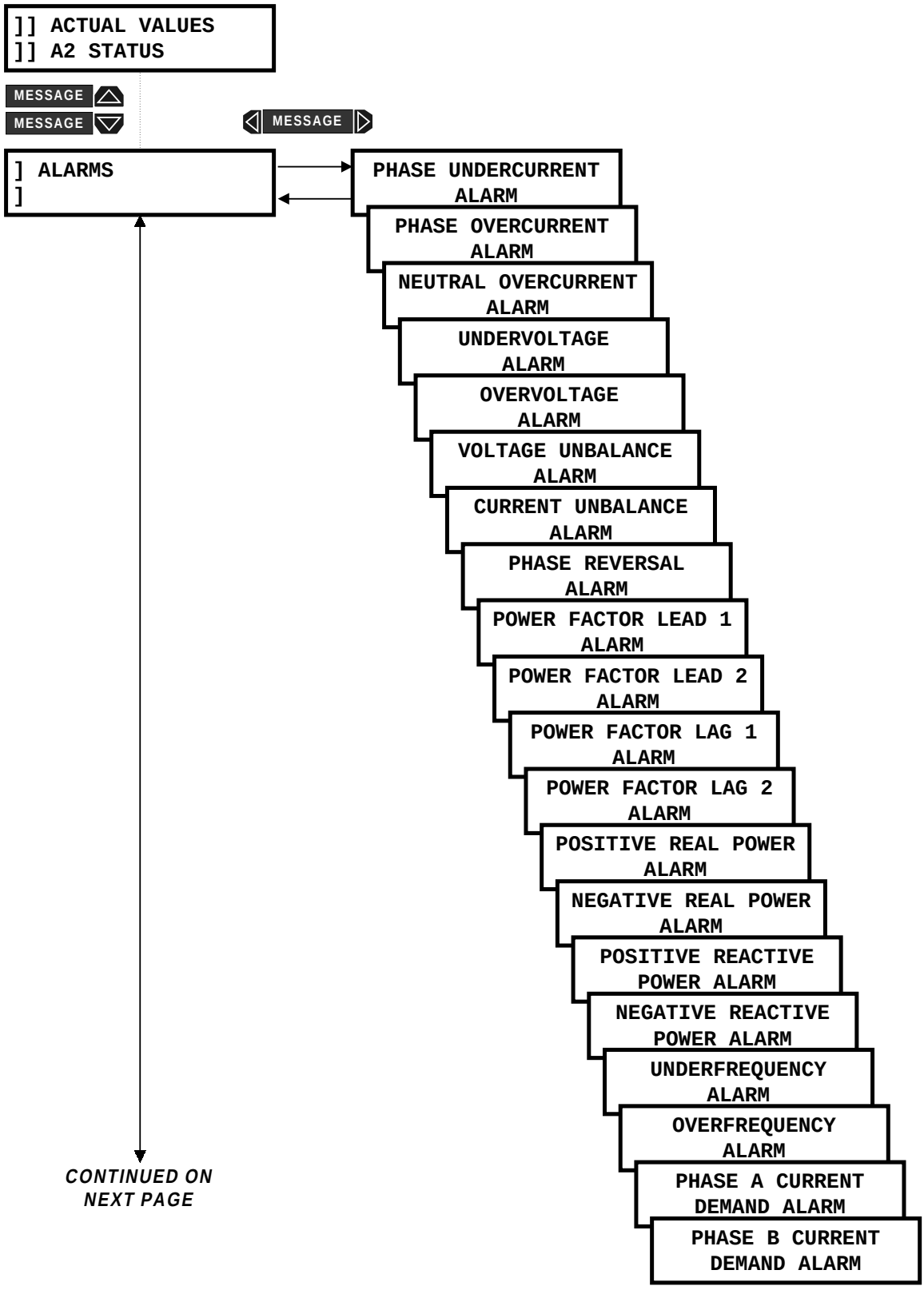
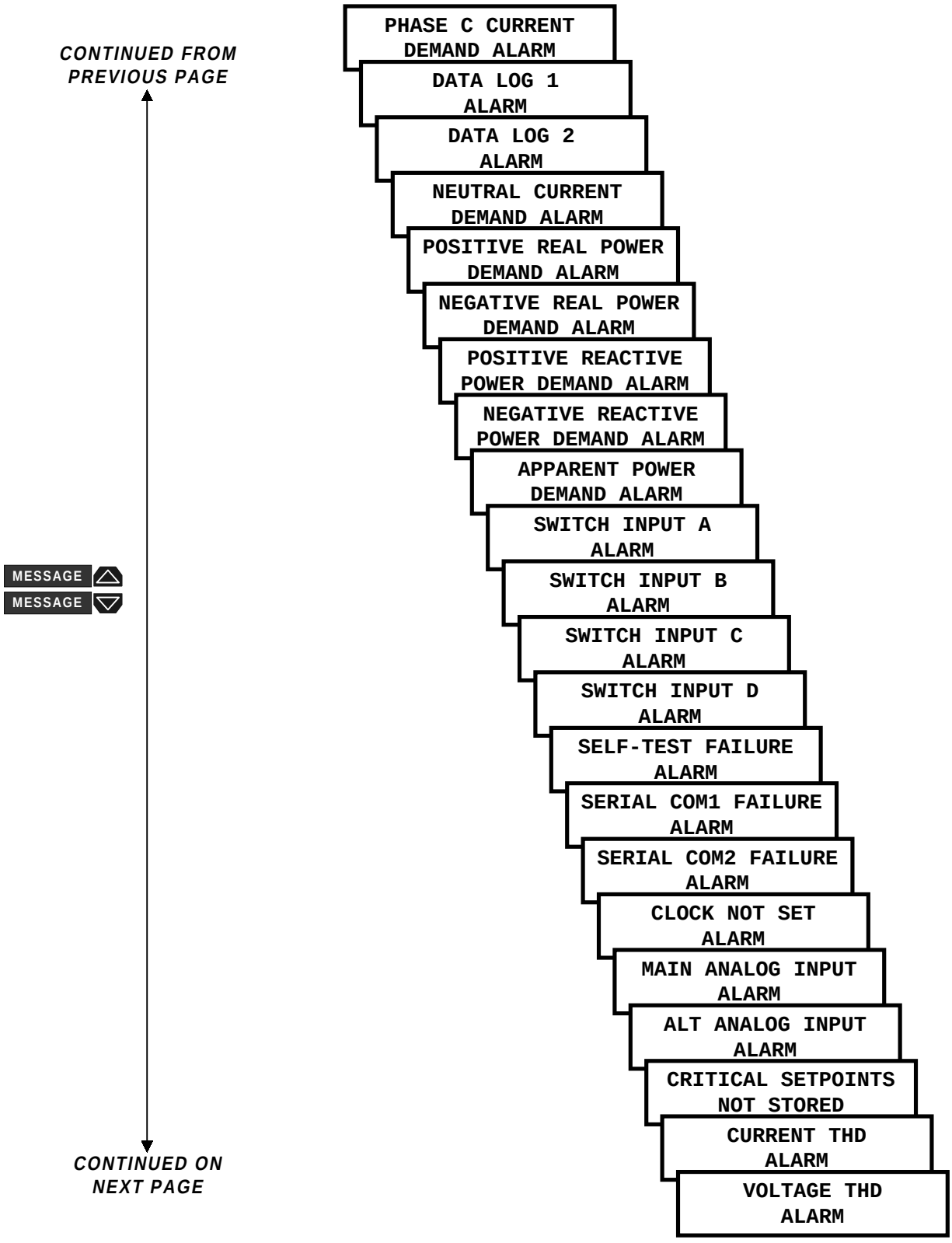


Figure 5–12: ACTUAL VALUES PAGE 1 – METERING / ANALOG INPUT

ANALOG INPUT: This message displays the measured 4 to 20 mA analog input scaled to the user defined name and units. The analog input can be configured via a switch input and output relay to multiplex two analog input signals. The displayed user defined name and units will change to the corresponding values depending upon which analog input is connected. Refer to chapter 4, Analog Input, for information regarding user defined names and units as well as analog input multiplexing.


]] ACTUAL VALUES
]] A2 STATUS
MESSAGE
MESSAGE
MESSAGE
] ALARMS
]
PHASE UNDERCURRENT ALARM
PHASE OVERCURRENT ALARM
NEUTRAL OVERCURRENT ALARM
UNDERVOLTAGE ALARM
OVERVOLTAGE ALARM
VOLTAGE UNBALANCE ALARM
CURRENT UNBALANCE ALARM
PHASE REVERSAL ALARM
POWER FACTOR LEAD 1 ALARM
POWER FACTOR LEAD 2 ALARM
POWER FACTOR LAG 1 ALARM
POWER FACTOR LAG 2 ALARM
POSITIVE REAL POWER ALARM
NEGATIVE REAL POWER ALARM
POSITIVE REACTIVE POWER ALARM
NEGATIVE REACTIVE POWER ALARM
UNDERFREQUENCY ALARM
OVERFREQUENCY ALARM
PHASE A CURRENT DEMAND ALARM
PHASE B CURRENT DEMAND ALARM
CONTINUED ON NEXT PAGE


CONTINUED FROM PREVIOUS PAGE
MESSAGE
MESSAGE
PHASE C CURRENT DEMAND ALARM
DATA LOG 1 ALARM
DATA LOG 2 ALARM
NEUTRAL CURRENT DEMAND ALARM
POSITIVE REAL POWER DEMAND ALARM
NEGATIVE REAL POWER DEMAND ALARM
POSITIVE REACTIVE POWER DEMAND ALARM
NEGATIVE REACTIVE POWER DEMAND ALARM
APPARENT POWER DEMAND ALARM
SWITCH INPUT A ALARM
SWITCH INPUT B ALARM
SWITCH INPUT C ALARM
SWITCH INPUT D ALARM
SELF-TEST FAILURE ALARM
SERIAL COM1 FAILURE ALARM
SERIAL COM2 FAILURE ALARM
CLOCK NOT SET ALARM
MAIN ANALOG INPUT ALARM
ALT ANALOG INPUT ALARM
CRITICAL SETPOINTS NOT STORED
CURRENT THD ALARM
VOLTAGE THD ALARM
CONTINUED ON NEXT PAGE

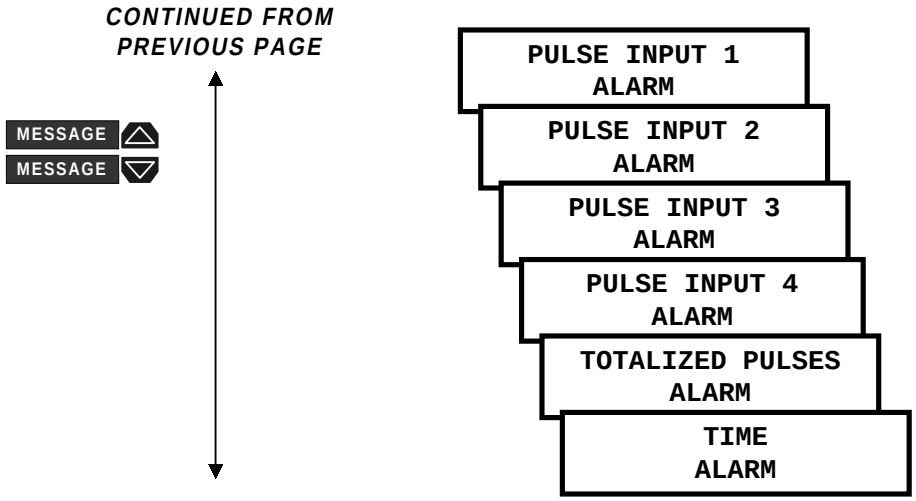


Figure 5–13: ACTUAL VALUES PAGE 2 – STATUS / ALARMS

The alarm messages appear only when the alarm threshold has been exceeded for the programmed time. When an alarm is assigned to an output relay, the relay can be set to be unlatched or latched. When the alarm is set as unlatched, it automatically resets when the alarm condition no longer exists. If the alarm is set as latched, a keypad reset or a serial port reset is required.

5

NOTE

The **SELF TEST ALARM** occurs if a fault in the PQM hardware is detected. This alarm is permanently assigned to the alarm output relay and is not user configurable. If this alarm is present, contact the GE Power Management Service Department.

5.3.2 SWITCH STATUS

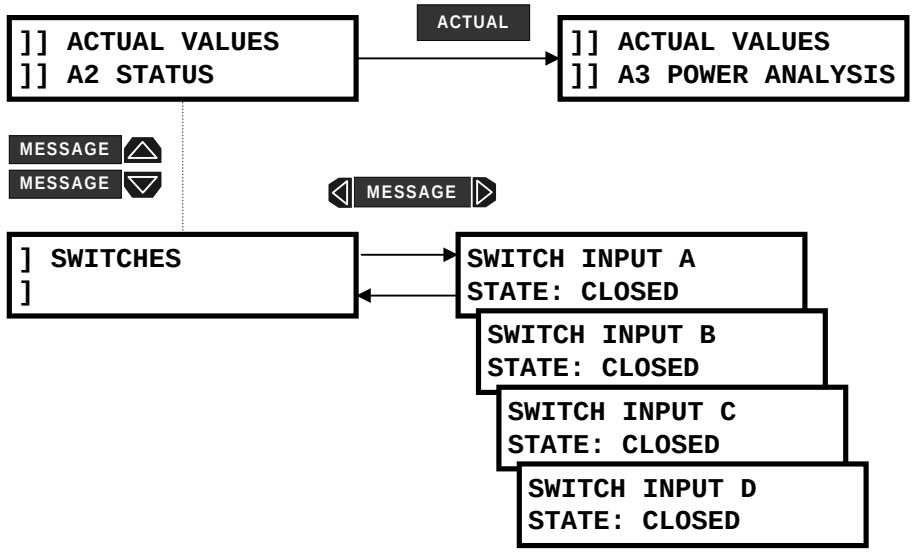


Figure 5–14: ACTUAL VALUES PAGE 2 – SWITCH STATUS

SWITCH INPUT A/B/C/D STATE: To assist in troubleshooting, the state of each switch can be verified using these messages. A separate message displays the status of each input identified by the corresponding name as shown in the wiring diagrams in chapter 2. For a dry contact closure across the corresponding switch terminals the message will read CLOSED.

5.3.3 CLOCK

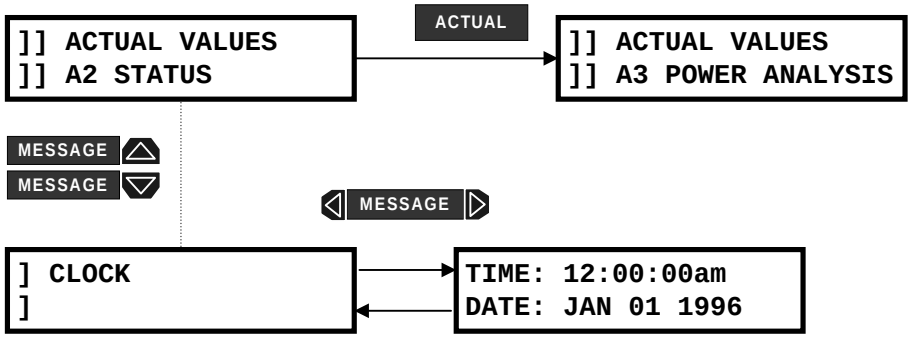


Figure 5–15: ACTUAL VALUES PAGE 2 – CLOCK

TIME/DATE: The current time and date is displayed in this message. The PQM uses an internally generated software clock which runs for at least one hour after the control power has been removed. To set the clock, see setpoints page **S1 PQM SETUP \ CLOCK**. The **S4 ALARMS/CONTROL \ MISCELLANEOUS \ CLOCK NOT SET ALARM** alarm occurs if power has been removed for longer than 1 hour and the clock value has been lost.

5.3.4 PROGRAMMABLE MESSAGE

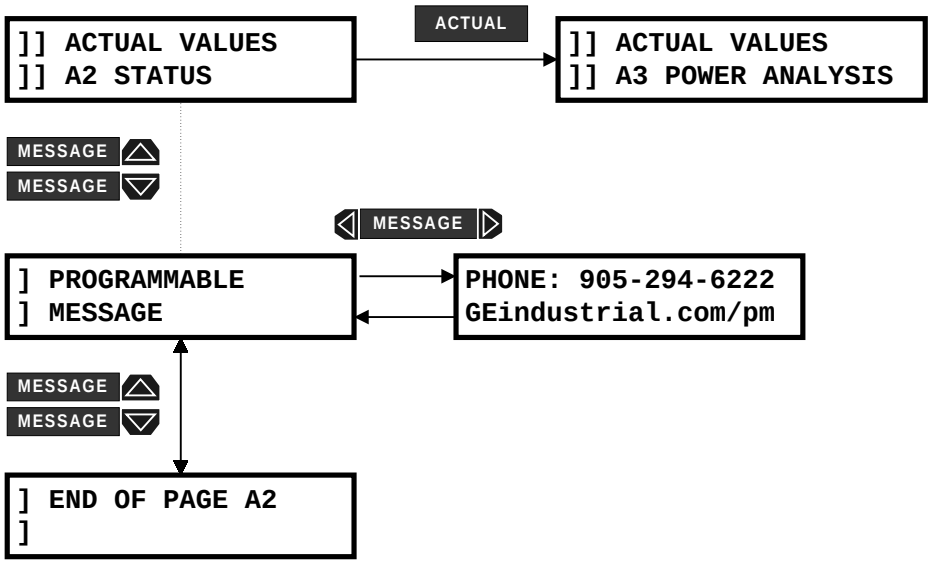


Figure 5–16: ACTUAL VALUES PAGE 2 – PROGRAMMABLE MESSAGE

A 40-character user defined message is displayed. The message is programmed using the keypad or via the serial port using PQMPC. See **S1 PQM SETUP \ PROGRAMMABLE MESSAGE** for programming details.

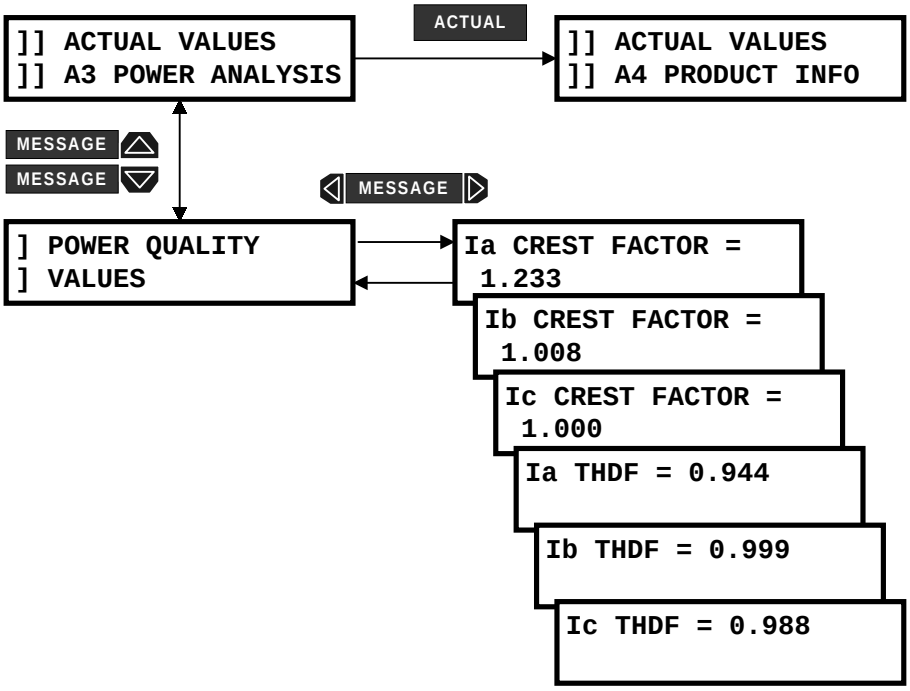


Figure 5–17: ACTUAL VALUES PAGE 3 – POWER QUALITY VALUES

Ia / Ib / Ic CREST FACTOR: The crest factor describes how much the load current can vary from a pure sine wave while maintaining the system's full rating. A completely linear load (pure sine wave) has a crest factor of $\sqrt{2}$ $(1/0.707)$, which is the ratio of the peak value of sine wave to its rms value. Typically, the crest factor can range from $\sqrt{2}$ to 2.5.

Ia/Ib/Ic THDF: Transformer Harmonic Derating Factor (THDF), also known as CBEMA factor, is defined as the crest factor of a pure sine wave ($\sqrt{2}$) divided by the measured crest factor. This method is useful in cases where lower order harmonics are dominant. In a case where higher order harmonics are present, it may be necessary to use a more precise method (K-factor) of calculating the derating factor. This method also does not take into consideration the losses associated with rated eddy current in the transformer. The PQMPC software provides the K-factor method of calculating the derating factor, which is defined on a per unit basis as follows:

$$K = \sum_{h=1}^{h_{max}} I_h \times h^2$$

where: I_h = rms current at harmonic *h,* in per unit of rated rms load current

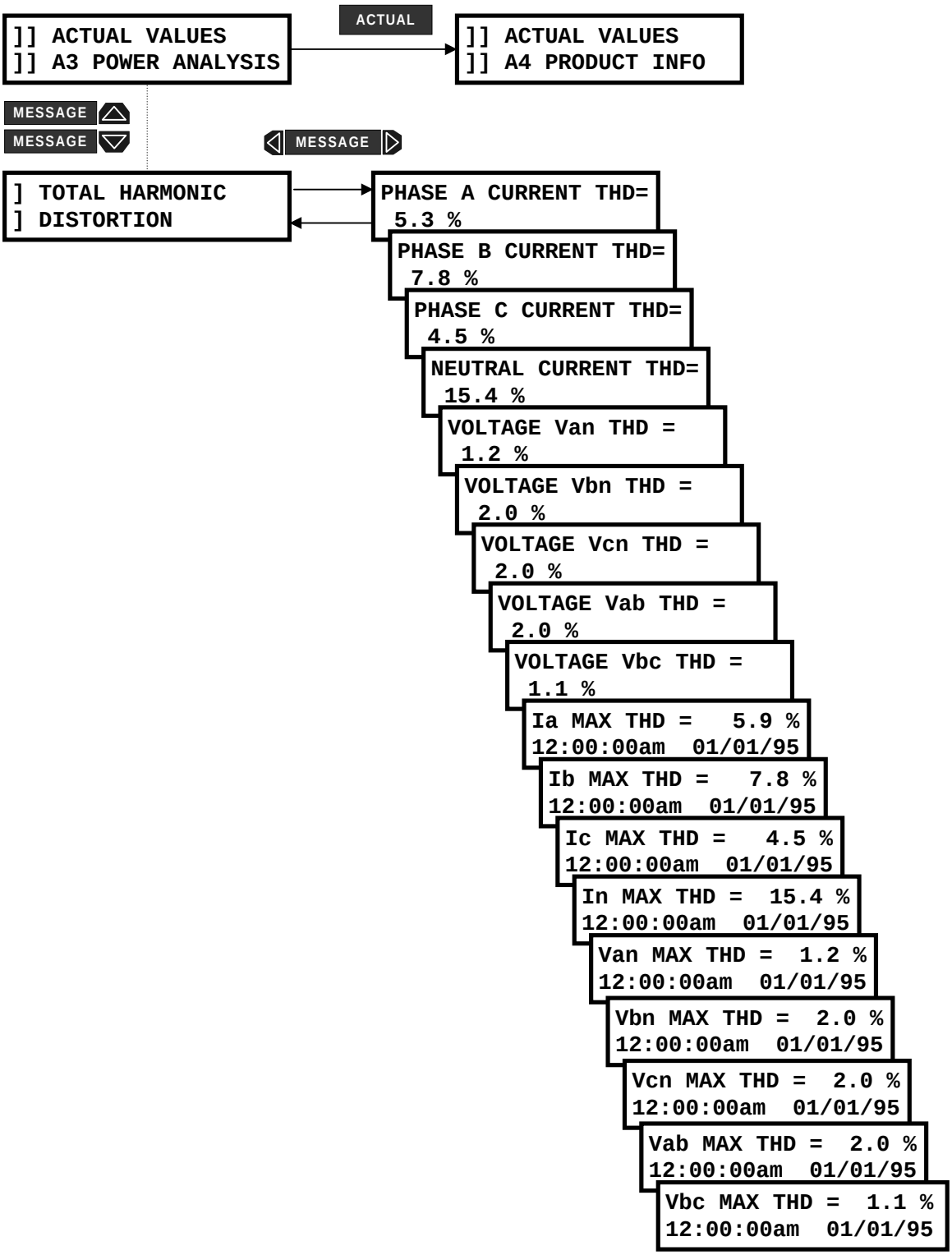


Figure 5–18: ACTUAL VALUES PAGE 3 – TOTAL HARMONIC DISTORTION

PHASE A/B/C/N CURRENT THD: These messages display the calculated total harmonic distortion for each current input.

VOLTAGE Van/Vbn/Vcn/Vab/Vbc THD: These messages display the calculated total harmonic distortion for each voltage input. Phase to neutral voltages will appear when the setpoint **S2 SYSTEM SETUP \ CURRENT/VOLTAGE CONFIGURATION \ VT WIRING** is stored as WYE. Line to line voltages will appear when the setpoint **S2 SYSTEM SETUP \ CURRENT/VOLTAGE CONFIGURATION \ VT WIRING** is stored as DELTA.

Ia/Ib/Ic/In MAX THD: The maximum total harmonic value for each current input and the time and date which the maximum value occurred are displayed. The **S1 PQM SETUP \ CLEAR DATA \ CLEAR MAX THD VALUES** setpoint clears this value.

Van/Vbn/Vcn/Vab/Vbc MAX THD: These messages display the maximum total harmonic value for each voltage input and the time and date at which the maximum value occurred. The setpoint **S1 PQM SETUP \ CLEAR DATA \ CLEAR MAX THD VALUES** is used to clear this value. Phase to neutral voltages will appear when the setpoint **S2 SYSTEM SETUP \ CURRENT/VOLTAGE CONFIGURATION \ VT WIRING** is set to WYE. Line to line voltages will appear when the setpoint **S2 SYSTEM SETUP \ CURRENT/VOLTAGE CONFIGURATION \ VT WIRING** is set to DELTA.

5.4.3 DATA LOGGER

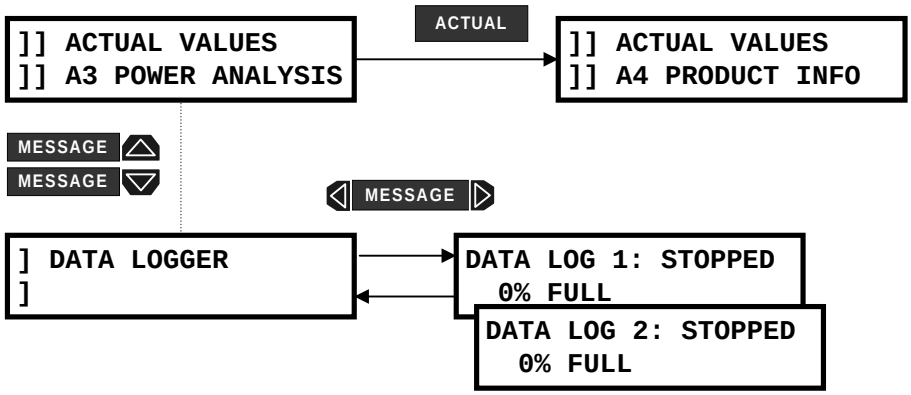


Figure 5–19: ACTUAL VALUES PAGE 3 – DATA LOGGER

DATA LOG 1: This message display the current status of the Data Logger 1. The Data Logger can be set up and run only from PQMPC. See Sections 6.6.4: DATA LOGGER on page 6–18 and A.1.6: DATA LOGGER IMPLEMENTATION on page A–12 for a details on the Data Logger feature.

NOTE

It is possible to stop the data logger from the PQM front panel using the **S2 SYSTEM SETUP/DATA LOGGER/STOP DATA LOGGER 1** setpoint.

DATA LOG 2: See DATA LOG 1 description above and replace all references to DATA LOGGER 1 with DATA LOGGER 2.

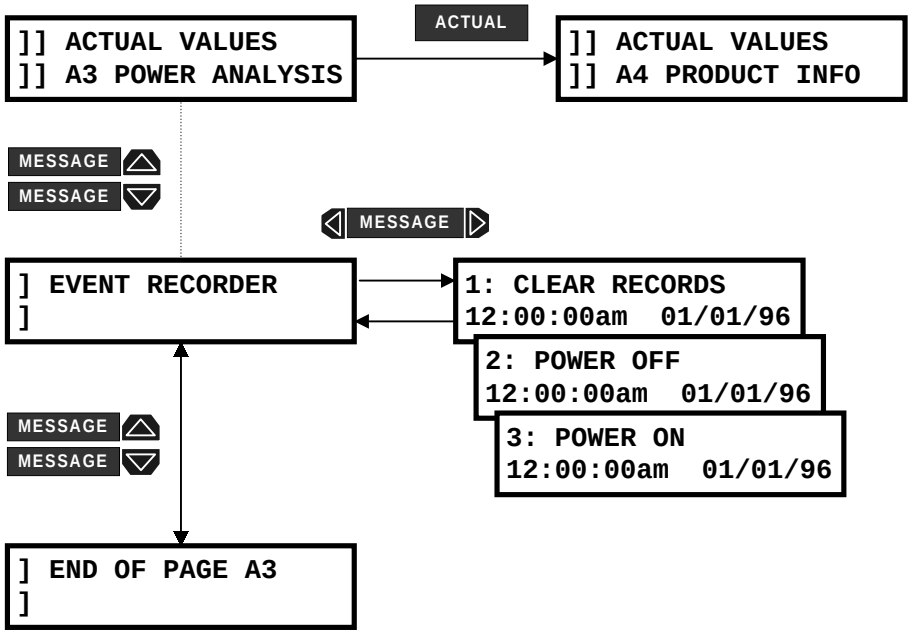


Figure 5–20: ACTUAL VALUES PAGE 3 – EVENT RECORDER

The PQM Event Recorder runs continuously and records the number, cause, time, date, and metering quantities present at the occurrence of each event. This data is stored in non-volatile memory and is not lost when power to the PQM is removed. The Event Recorder must be enabled in **S1 PQM SETUP \ EVENT RECORDER \ EVENT RECORDER OPERATION**. The Event Recorder can be cleared in **S1 PQM SETUP \ CLEAR DATA \ CLEAR EVENT RECORD**. Data for the 40 most recent events is stored. Event data for older events is lost. Note that the event number, cause, time, and date is available in the messages as shown in the following table, but the associated metering data is available only via serial communications.

EVENT RECORDS- EVENT NUMBER, EVENT CAUSE, TIME, DATE: These messages display the 40 most recent events recorded by the event recorder.

Table 5–1: LIST OF POSSIBLE EVENTS (Sheet 1 of 3)

EVENT NAME	DISPLAYED EVENT NAME
Undercurrent Alarm/Control Pickup	UNDERCURRENT ↑
Undercurrent Alarm/Control Dropout	UNDERCURRENT ↓
Overcurrent Alarm/Control Pickup	OVERCURRENT ↑
Overcurrent Alarm/Control Dropout	OVERCURRENT ↓
Neutral Overcurrent Alarm/Control Pickup	NEUTRAL ↑
Neutral Overcurrent Alarm/Control Dropout	NEUTRAL ↓
Undervoltage Alarm/Control Pickup	UNDERVOLTAGE ↑
Undervoltage Alarm/Control Dropout	UNDERVOLTAGE ↓
Overvoltage Alarm/Control Pickup	OVERVOLTAGE ↑
Overvoltage Alarm/Control Dropout	OVERVOLTAGE ↓
Current Unbalance Alarm/Control Pickup	CURRENT U/B ↑
Current Unbalance Alarm/Control Dropout	CURRENT U/B ↓
Voltage Unbalance Alarm/Control Pickup	VOLTAGE U/B ↑
Voltage Unbalance Alarm/Control Dropout	VOLTAGE U/B ↓
Phase Reversal Alarm/Control Pickup	PHASE REVERSAL↑
Phase Reversal Alarm/Control Dropout	PHASE REVERSAL↓
Power Factor Lead 1 Alarm/Control Pickup	PF LEAD 1 ↑
Power Factor Lead 1 Alarm/Control Dropout	PF LEAD 1 ↓
Power Factor Lag 1 Alarm/Control Pickup	PF LAG 1 ↑
Power Factor Lag 1 Alarm/Control Dropout	PF LAG 1 ↓
Power Factor Lead 2 Alarm/Control Pickup	PF LEAD 2 ↑
Power Factor Lead 2 Alarm/Control Dropout	PF LEAD 2 ↓
Power Factor Lag 2 Alarm/Control Pickup	PF LAG 2 ↑
Power Factor Lag 2 Alarm/Control Dropout	PF LAG 2 ↓
Positive Real Power Alarm/Control Pickup	POS kW ↑
Positive Real Power Alarm/Control Dropout	POS kW ↓
Negative Real Power Alarm/Control Pickup	NEG kW ↑
Negative Real Power Alarm/Control Dropout	NEG kW ↓
Positive Reactive Power Alarm/Control Pickup	POS kvar ↑
Positive Reactive Power Alarm/Control Dropout	POS kvar ↓
Negative Reactive Power Alarm/Control Pickup	NEG kvar ↑
Negative Reactive Power Alarm/Control Dropout	NEG kvar ↓
Underfrequency Alarm/Control Pickup	UNDRFREQUENCY ↑
Underfrequency Alarm/Control Dropout	UNDRFREQUENCY ↓
Overfrequency Alarm/Control Pickup	OVERFREQUENCY ↑
Overfrequency Alarm/Control Dropout	OVERFREQUENCY ↓
Positive Real Power Demand Alarm/Control Pickup	3Φ +kW DMD ↑
Positive Real Power Demand Alarm/Control Dropout	3Φ +kW DMD ↓
Negative Real Power Demand Alarm/Control Pickup	3Φ –kW DMD ↑

Table 5–1: LIST OF POSSIBLE EVENTS (Sheet 2 of 3)

EVENT NAME	DISPLAYED EVENT NAME
Negative Real Power Demand Alarm/Control Dropout	3Φ –kW DMD ↓
Positive Reactive Power Demand Alarm/Control Pickup	3Φ +kvar DMD ↑
Positive Reactive Power Demand Alarm/Control Dropout	3Φ +kvar DMD ↓
Negative Reactive Power Demand Alarm/Control Pickup	3Φ –kvar DMD ↑
Negative Reactive Power Demand Alarm/Control Dropout	3Φ –kvar DMD ↓
Apparent Power Demand Alarm/Control Pickup	3Φ kVA DEMAND ↑
Apparent Power Demand Alarm/Control Dropout	3Φ kVA DEMAND ↓
Phase A Current Demand Alarm/Control Pickup	Ia DEMAND ↑
Phase A Current Demand Alarm/Control Dropout	Ia DEMAND ↓
Phase B Current Demand Alarm/Control Pickup	Ib DEMAND ↑
Phase B Current Demand Alarm/Control Dropout	Ib DEMAND ↓
Phase C Current Demand Alarm/Control Pickup	Ic DEMAND ↑
Phase C Current Demand Alarm/Control Dropout	Ic DEMAND ↓
Neutral Current Demand Alarm/Control Pickup	In DEMAND ↑
Neutral Current Demand Alarm/Control Dropout	In DEMAND ↓
Switch Input A Alarm/Control Pickup	SW A ACTIVE ↑
Switch Input A Alarm/Control Dropout	SW A ACTIVE ↓
Switch Input B Alarm/Control Pickup	SW B ACTIVE ↑
Switch Input B Alarm/Control Dropout	SW B ACTIVE ↓
Switch Input C Alarm/Control Pickup	SW C ACTIVE ↑
Switch Input C Alarm/Control Dropout	SW C ACTIVE ↓
Switch Input D Alarm/Control Pickup	SW D ACTIVE ↑
Switch Input D Alarm/Control Dropout	SW D ACTIVE ↓
Pulse Input 1 Alarm/Control Pickup	PULSE IN 1 ↑
Pulse Input 1 Alarm/Control Dropout	PULSE IN 1 ↓
Pulse Input 2 Alarm/Control Pickup	PULSE IN 2 ↑
Pulse Input 2 Alarm/Control Dropout	PULSE IN 2 ↓
Pulse Input 3 Alarm/Control Pickup	PULSE IN 3 ↑
Pulse Input 3 Alarm/Control Dropout	PULSE IN 3 ↓
Pulse Input 4 Alarm/Control Pickup	PULSE IN 4 ↑
Pulse Input 4 Alarm/Control Dropout	PULSE IN 4 ↓
Totalized Pulses Alarm/Control Pickup	PULSE TOTAL ↑
Totalized Pulses Alarm/Control Dropout	PULSE TOTAL ↓
Current THD Alarm/Control Pickup	CURRENT THD ↑
Current THD Alarm/Control Dropout	CURRENT THD ↓
Voltage THD Alarm/Control Pickup	VOLTAGE THD ↑
Voltage THD Alarm/Control Dropout	VOLTAGE THD ↓
Main Analog Input Alarm/Control Pickup	AN INPUT MAIN ↑
Main Analog Input Alarm/Control Dropout	AN INPUT MAIN ↓

Table 5–1: LIST OF POSSIBLE EVENTS (Sheet 3 of 3)

EVENT NAME	DISPLAYED EVENT NAME
Alternate Analog Input Alarm/Control Pickup	AN INPUT ALT ↑
Alternate Analog Input Alarm/Control Dropout	AN INPUT ALT ↓
Self Test Failure Alarm Pickup	SELF TEST ↑
Self Test Failure Alarm Dropout	SELF TEST ↓
COM1 Failure Alarm Pickup	COM1 FAILURE ↑
COM1 Failure Alarm Dropout	COM1 FAILURE ↓
COM2 Failure Alarm Pickup	COM2 FAILURE ↑
COM2 Failure Alarm Dropout	COM2 FAILURE ↓
Clock Not Set Alarm Pickup	CLOCK NOT SET ↑
Clock Not Set Alarm Dropout	CLOCK NOT SET ↓
Critical Setpoints Not Stored Alarm Pickup	PARAM NOT SET ↑
Critical Setpoints Not Stored Alarm Dropout	PARAM NOT SET ↓
Data Log 1 Alarm Pickup	DATA LOG 1 ↑
Data Log 1 Alarm Dropout	DATA LOG 1 ↓
Data Log 2 Alarm Pickup	DATA LOG 2 ↑
Data Log 2 Alarm Dropout	DATA LOG 2 ↓
Time Alarm/Control Pickup	TIME ↑
Time Alarm/Control Dropout	TIME ↓
Power On	POWER ON
Power Off	POWER OFF
Latched Alarm/Auxiliary Reset	ALARM RESET
Setpoint Access On	PROGRAM ENABLE
Trace Memory Triggered	TRACE TRIG ↑

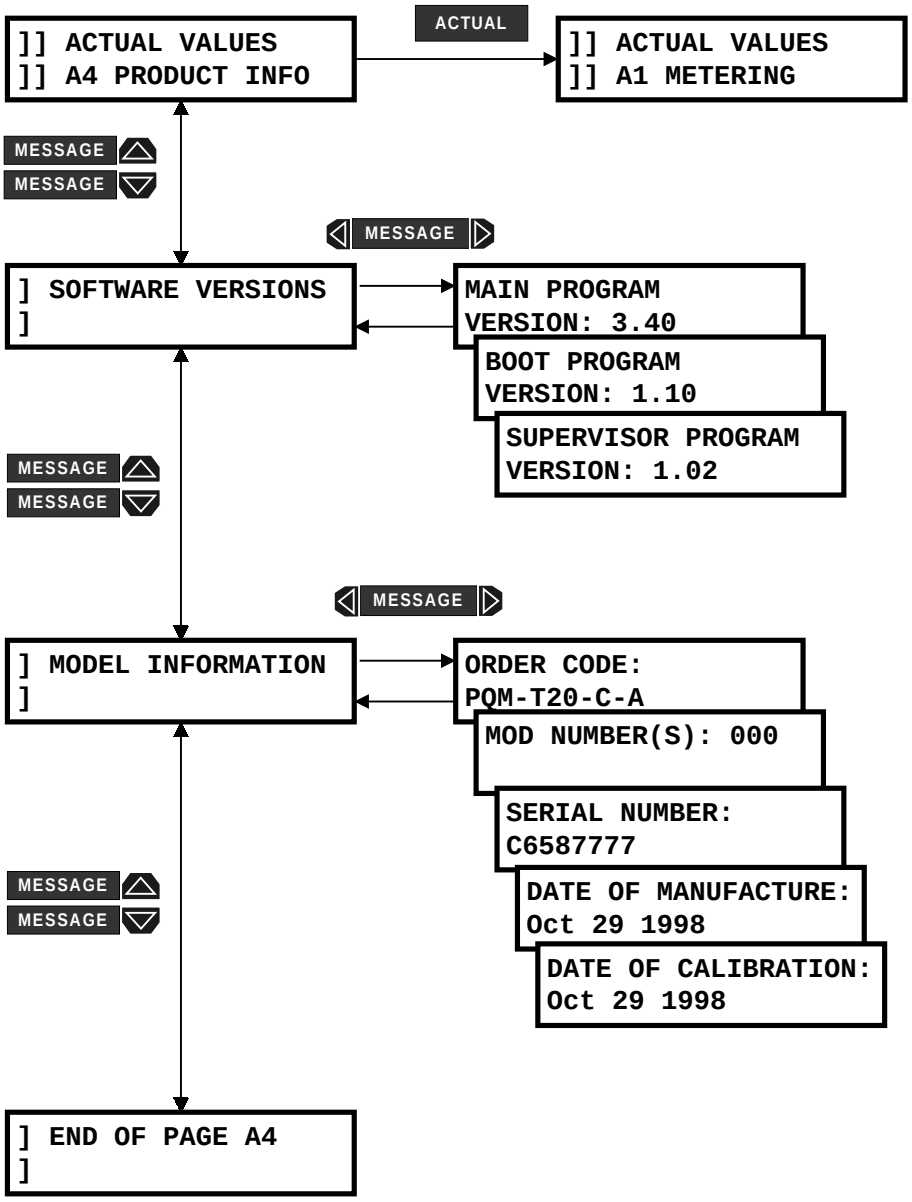


Figure 5–21: ACTUAL VALUES PAGE 4 – SOFTWARE VERSIONS

a) SOFTWARE VERSIONS

Product software revision information is contained in these messages.

MAIN PROGRAM VERSION: When referring to documentation or requesting technical assistance from the factory, record the **MAIN PROGRAM VERSION** and **MODIFICATION FILE NUMBER**. The **MAIN PROGRAM VERSION** identifies the firmware installed internally in the flash memory. The title page of this instruction manual states the main program revision code for which the manual is written. There may be differences in the product and manual if the revision codes do not match.

BOOT PROGRAM VERSION: This identifies the firmware installed internally in the memory of the PQM. This does not affect the functionality of the PQM.

SUPERVISOR PROGRAM VERSION: This identifies the firmware installed internally in the supervisor (power fail) processor of the PQM. This does not affect the functionality of the PQM.

b) MODEL INFORMATION

Product identification information is contained in these messages.

ORDER CODE: This indicates which features were ordered with this PQM. T = Transducer option (T20=4-20 mA, T1=0-1 mA Analog Outputs), C = Control option, A = Power Analysis option.

MOD NUMBER(S): If unique features have been installed for special customer orders, the **MOD NUMBER** will be used by factory personnel to identify the matching product records. If an exact replacement model is required, the **MAIN PROGRAM VERSION**, **MOD NUMBER**, **ORDER CODE**, **SERIAL NUNBER** should be specified with the order.

SERIAL NUMBER: This is the serial number of the PQM. This should match the number on the label located on the back of the PQM.

DATE OF MANUFACTURE: This is the date the PQM was final tested at GE Power Management.

DATE OF CALIBRATION: This is the date the PQM was last calibrated.