

# Application Note

# AN0304

## ET3 Display Output Port Communications Protocol

**Associated Product:** ET3

### Summary

The ET3 comes standard with an RS-485 (Modbus RTU) Communications port as well as a dedicated output port for the Remote Display. This output consists of three terminals on the digital output connector. This terminal is labelled +V, DSPL and GND. +V provides 12VDC at 150mA. The DSPL terminal provides a packet data stream every one-second with meter parameters. The DSPL terminal uses a UART to generate the data, however it is at a TTL (0-5V level) that may be directly compatible with standard microprocessor UARTs.

A TTL to RS-232 level converter will be required to interface this output with that of a PC.

The DSPL port is unidirectional, and thus only outputs metering data. Meter configuration may only be programmed via the RS-485 Modbus RTU port.

Signal Level	TTL (0-5VDC)
Baud Rate	19,200
Parity	None
Data Bits	8
Stop Bits	1

### Checksum Calculation

8-bit unsigned value:

1. Add all bytes (0-41) in the message into an 8-bit field, so that carries will be discarded.
2. Subtract the final field value from FF hex (all 1's), to produce the ones-complement.
3. Add 1 to produce the twos-complement.

### Data Manipulation

The data stream consists of twenty-one 2-byte (16-bit "integer") values. kWh is composed of two 16-bit integers (32-bit total).

To convert the values into "Engineering Units", it is required to divide the number by the specified "divider" (ie: insert the decimal point). For example, a value of "5999" in the frequency integer represents "59.99 Hz".

Note that the CT ratios and PT ratios must be applied by the user (the meter does not do the multiplication, except for kWh). Currents must be multiplied by the CT ratio. Voltages must be multiplied by the PT ratio. Watts, VA, and Demand must be multiplied by both PT and CT ratio.

NOTE: The meter does incorporate the CT and PT ratios into the kWh (energy) measurements, thus the energy register does not need to be multiplied by the user.

Byte Offset	Data Length (bits)	Name	Description	Divider	Units
0	16	Ir	CT Ratio (to be used in final calculations of Amps, Watts, VA) Can be changed via Modbus	1	
2	16	Vr	PT Ratio (to be used in final calculation of Volts, Watts, VA) Can be changed via Modbus	1	
4	16	Ia	Current in phase A	1,000	A
6	16	Ib	Current in phase B	1,000	A
8	16	Ic	Current in phase C	1,000	A
10	16	Va	Voltage in phase A	10	V
12	16	Vb	Voltage in phase B	10	V
14	16	Vc	Voltage in phase C	10	V
16	16	Pa	Real Power (W) in phase A	10	W
18	16	Pb	Real Power (W) in phase B	10	W
20	16	Pc	Real Power (W) in phase C	10	W
22	16	Sa	Apparent Power (VA) in phase A	10	VA
24	16	Sb	Apparent Power (VA) in phase B	10	VA
26	16	Sc	Apparent Power (VA) in phase C	10	VA
28	16	32	kWh TTL (hi)	10	kWh
30	16		kWh TTL (lo)		
32	16	TTL Real Pwr	Total Real Power (Pa+Pb+Pc)	10	W
34	16	TTL Appr Pwr	Total Appr Power (Sa+Sb+Sc)	10	VA
36	16	System Cos	System Power Factor (PF)	10,000	
38	16	Freq	Line Frequency (read from excitation line) (Hz)	100	Hz
40	16	Power Demand	Calculated demand power, based on sliding window time defined via Modbus	10	W
42	8	LRC	8-bit Checksum		

### Considerations

- The DSPL port does not include per-phase PF information (ie: it only includes total system power factor). To compute per-phase information, the user may calculate the power factor using the VA and W from each phase. Ie: (fa = Wa/VAa)
- The ET3 only measures Line-to-Neutral voltages. In the case of a three-phase system where line-to-line voltages are required, they may be calculated using the appropriate L-N voltages and cosine law. Ie:

$$V_{ab} = \sqrt{V_a^2 + V_b^2 + (V_a * V_b)}. \text{ This equation assumes an equal } 120^\circ \text{ phase shift between phases.}$$