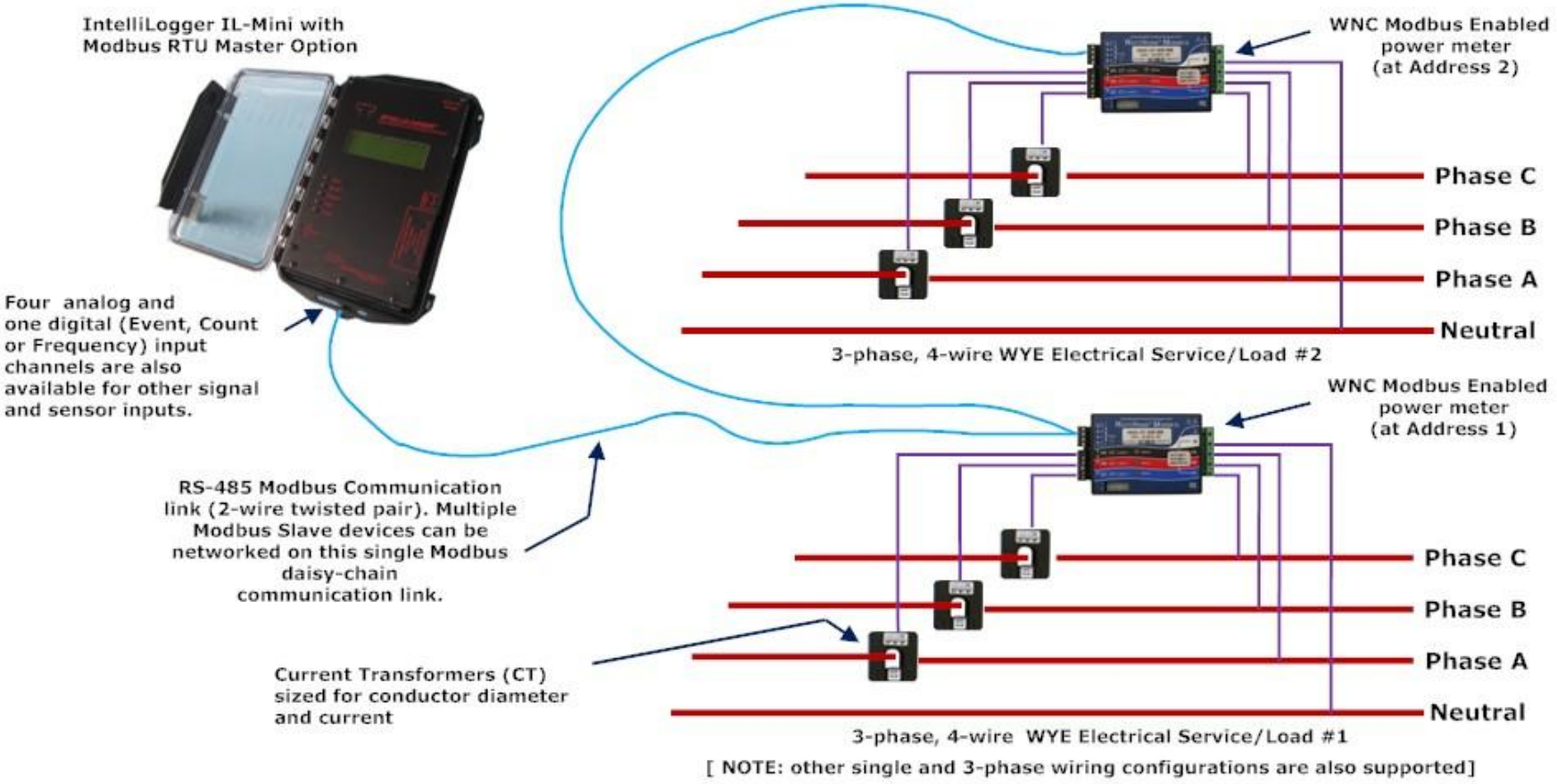
LOGIC BEACH INC

AN 512; IntelliLogger IL-Mini™ Application:

3-Phase Energy Data Acquisition via WNC Modbus Meters

THREE-PHASE ENERGY DATA ACQUISITION SYSTEM USING THE IL-MINI™

The IL-Mini™ data logger coupled with one or more WNC Modbus output power meters results in a flexible, stand-alone, multi-parameter electrical power data acquisition system. Shown below is the IL-Mini™ logging electrical parameter from two 3-phase electrical loads. In the following Chiller Performance Analysis application, logging electrical parameters from the cooling tower fan(s), pump(s) and chiller compressor is readily handled with a single IL-Mini™ Data Logger and multiple Modbus networked electrical meters. This frees up the IL-Mini™ analog channels for additional sensor inputs such as temperature, flow, humidity, etc.



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SYSTEM EXPLANATION:

The WNC Modbus enabled electrical meter is configured as a Modbus Slave device, assigned a network address and connected to the high-voltage electrical service or load to be measured. The WNC requires electrical voltage sensing connections to each of the phases as well as current transformers (CT's) for current measurement on each of the phase conductors. The WNC power meter runs autonomously sampling the phase voltages and currents very quickly, calculating phase voltages, phase currents, Power Factor, instantaneous power and a multitude of other electrical parameters. The WNC updates internal memory registers with these values as they are calculated.

The IL-Mini™ data logger enabled with the Modbus RTU Master option is connected to the WNC meter(s) via a twisted wire pair in a daisy chain configuration. During operation, the IL-Mini™ reads the WNC Slave device registers containing the electrical parameters and uses them in the Program Net per the user's configuration, logging them to memory, performing calculations, alarming and more.

In addition to the Modbus interface, the IL-Mini™ also has 4 analog input channels and one digital input (Event, Counter or Frequency) to which other transducer and signal inputs can be connected for simultaneous data acquisition as in the following chiller monitoring example.

IL-MINI™ PROGRAMMING

To configure the IL-Mini™ for the desired data acquisition and alarming functions, a program is built within the Logic Beach HyperWare-II software. This program is called a "Program Net" as it consists of a number of icons all visually connected together with a mouse to make a "network". The Program Net is then uploaded to the IL-Mini™ memory where it executes. Due to the intuitive flexibility of the HyperWare-II software, there are unlimited data acquisition schemes that can be implemented with the Program Net.

Below is a Program Net that acquires electrical, temperature and humidity performance data on a vapor compression chiller system. Parameters measured and logged include:

CHILLED WATER SUPPLY AND RETURN TEMPERATURES

In the upper left corner of the Program Net, two thermocouples are used to measure the chilled water supply and return pipe temperatures every 30 Seconds. Additionally, the differential temperature is calculated with the Math icon titled *Tdelta.* All three channels pass through a *Delta* icon before being stored to logger memory. The Delta icon is user configured to only pass data through to memory if the signal value changes by some user defined amount since the last time the value was stored to memory. This is a powerful feature that minimizes the amount of repetitive data being stored to memory without missing transient waveforms that might be of importance.

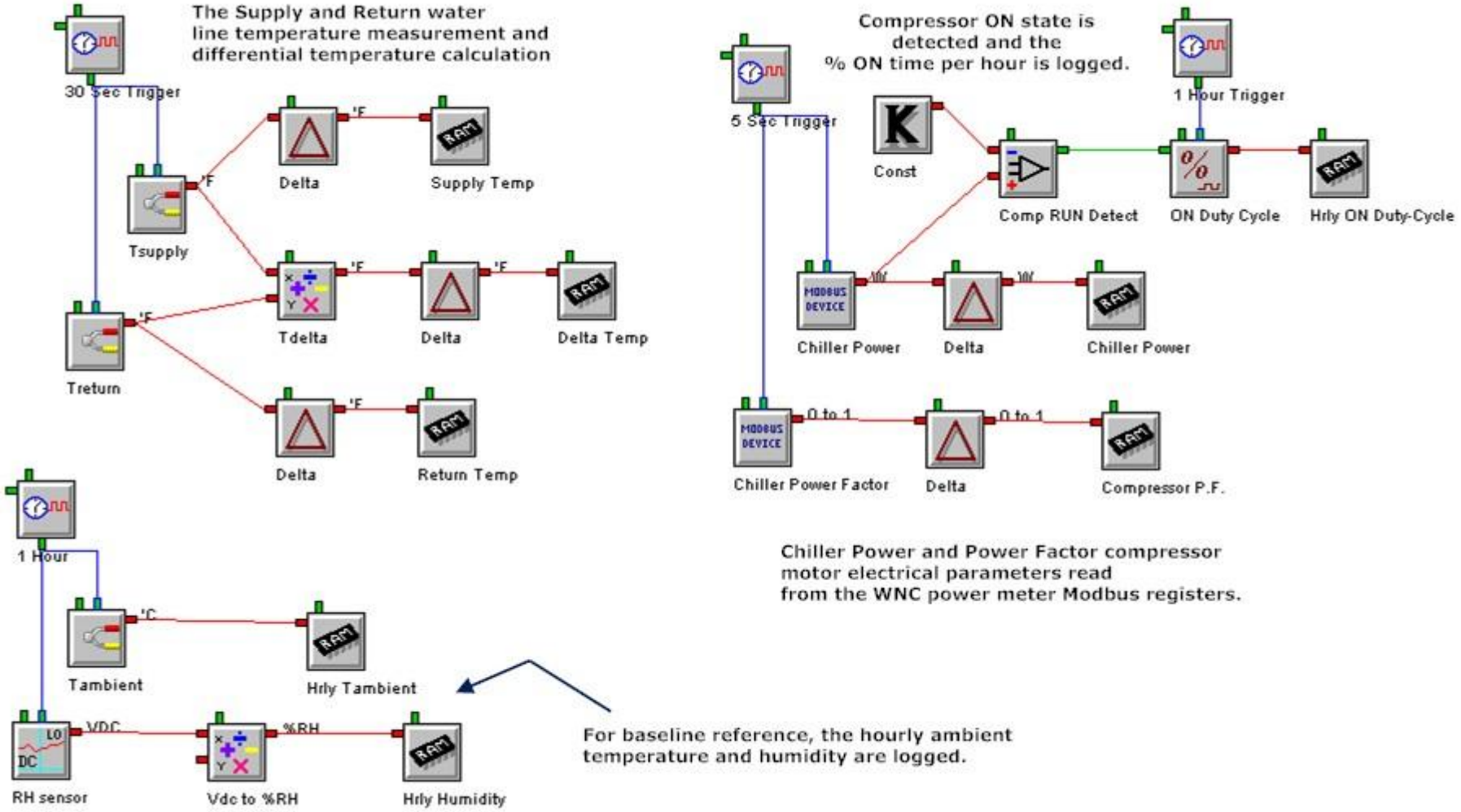
AMBIENT TEMPERATURE AND HUMIDITY CONDITIONS

In the lower left corner of the Program Net, a thermocouple is used to directly measure the ambient temperature and a mVdc output humidity transducer is used for humidity sensing. The mVdc signal from the humidity transducer is scaled to %rH via the Math icon and both the temperature and humidity are stored to memory every hour. With simple modifications to the Program Net, the min, max and/or average values could be stored instead.

CHILLER COMPRESSOR PERFORMANCE

On the right side of the Program Net, the compressor motor power and power factor are measured by the connected WNC meter. Via the Modbus link, these two parameters are read every 5 seconds by the IL-Mini™ from the WNC internal registers. As above, via Delta icons, the power factor and instantaneous power are stored to logger memory.

Additionally, a Setpoint Comparator named *Comp RUN Detect* is used to determine when the compressor is running. When the power level seen by the Setpoint Comparator exceeds the fixed constant value (icon named Const), the comparator output goes HIGH. The following Duty-Cycle icon, named *ON Duty Cycle* then calculates the ON time per hour as a percentage and passes this value to logger memory.



Chiller Temperatures, Compressor Power, Run-Time Duty-Cycle and Ambient Condition Logging

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SYSTEM COMPONENTS

The following components make up this chiller logging system. Links to the Logic Beach Website for further details are provided. Component costs are on the Logic Beach price schedules. Additionally, comments are included

Part Number	Description	Qty	Comment
IL-Mini-LCD-MRM-TC	IntelliLogger IL-Mini™ with the LCD display, thermocouple analog inputs and Modbus RTU Master options.	1	The display is not required but provides a great on-site display of actual readings during operation.
3539.22000	IL-Mini™ Surface/wall mounting bracket	1	If desired
WNC-3Y-480-PMB	Electrical Meter; Modbus interface for 277/480Vac Wye electrical service with neutral	1	Other models are available for other service configurations.
CTS-750-100	Split-Core Curernt Transformer. 0.75" aperture (opening), 100Aac full scale.	3	CT's with other apertures and full scale current ratings are available
RH-1A	Humidity transducer	1	
Thermocouple Probes	Thermocouple temperature probes	3	A variety of thermocouple probes are available from Logic Beach
HW2M	HyperWare-II for IL-Mini™ Single User License	1	If not already owned.
USB Cable	USB Cable; Type A to Mini-B	1	If not already owned. This is a common cable used with cameras and other USB devices.