VERSATRONIK 505

KWE Technologies Group

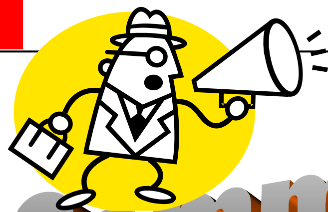
Brand New Day!

Welcome to the beginning of a new newsletter from K-W Electronic Service Inc. Consider this issue as #10 of KWE newsletters continued from the past. If you have already read or reviewed the first nine, you will know what this newsletter has provided in the past and what its intentions are for he future. For those of you that have not read the previous versions, they can be downloaded from our KWE website at, www.kwe-tech.com under the Vitotalk heading...I guess we will have to change that too!

As you can see, the first obvious change is that we have a new name *Versatronik® 505*. We felt that this is a fitting new name, as this is the name for our communications gateway product. This new name is representative of both the *information* and the *product* that bears its name. As time goes on, it will become clearer as to what the "*505*" represents. However, for the time being, let's continue where we left off.

We hope that you enjoy the newsletter and should you have any input, do not hesitate to let us know.

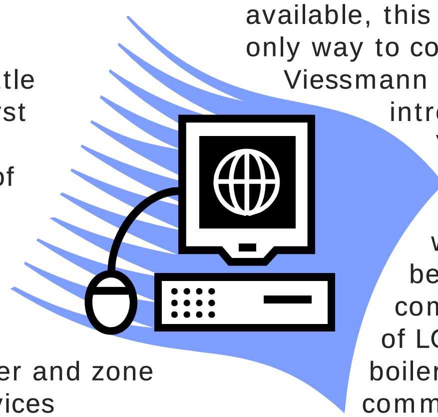
So, please continue reading and find out what this issue brings and how it will be an invaluable tool for future reference. Thank you for taking the time.



Communication

Over the last 10 years there has been incredible growth in the use of communications to integrate Viessmann boiler controls into BMS/ DDC systems. With this growth, the need for skilled individuals who know what is required is paramount. From a single boiler control to a complete cascade system with a communication gateway, knowledge and the desire to learn makes all the difference in the world.

Let's start with a little history first! The first communication gateway was part of the Dekamatik control family. The intent of these gateways was to allow integration of the Dekamatik boiler and zone controls. These devices communicated over the proprietary Viessmann 141 two-wire BUS communication protocol. The most popular gateway was a Vitocom LON device followed by a N2 gateway that were used in some Johnson Controls applications.



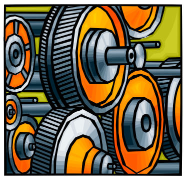
The Vitocom LON gateway allowed access to boiler temperatures, DHW operation as well as information about heating zone controls with the ability to adjust the slope, shift, sun and moon settings. This gateway was a very popular product as, like the current controls, Viessmann had no equal when it came to the overall system approach and the ability to provide information to integrators. The first newsletter to provide an overview of all the communication possibilities was Vitotalk 8 released in February 2005. Since then, a whole lot has changed.

When the Vitocom controls were available, this gateway was the only way to communicate to non-Viessmann devices. With the introduction of the NR2 Vitotronic controls from Viessmann, the available options were increased because of the open communication protocol of LONworks®. While the boiler and zone controls communicate via LON, the algorithms used to stage the boilers are uniquely Viessmann.

The Vitotronic boiler and system controls are able to communicate with one another by a program which runs when they are commissioned. This "program" is usually referred to as Autobinding. This effectively sets up all the necessary logical bindings to manage the operation of the controls. These bindings manage error handling, setpoint functions,

Communication Cont'd on page 4

Relationships



Relationships...Hey, where are you going?!?!

The word relationships brings to mind very specific connotations. The relationships that are the focus of this article are not the warm and fuzzy kind, but rather cold and consistent. Not the kind that takes you back to a time when you were an awkward teenager, with acne and raging hormones, but rather ones that help us to live day-to-day in the world of HVAC.

Each and every technical aspect has its own inherent relationships. These are not mathematical equations, but just some plain ole concepts that the majority of us use and understand.

Depending on how much analysis is applied to each technical relationship, you will easily understand how various aspects can impact each other. So, let's try to explore the interrelated relationships from a single starting point. C'mon, we are not asking you talk about your feelings here now!

> *Once a new technology rolls over you, if you are not part of the steamroller, you're part of the road.*
>
> Stewart Brand

One of the most basic relationships which we know and love, but one that can confuse and mystify is the heating curve. This can turn the most seasoned professionals into babbling idiots. The basis of this relationship is to maintain a consistent indoor air temperature, while the outdoor temperature changes. But, hey, it doesn't stop there, as the outdoor temperature changes, the correct supply temperature must be provided to keep the ambient temperature within the desired value. The need for more heat is required, as it gets colder and conversely as the outdoor temperature increases, the less heat is required. Of course, there is a point where cooling is necessary depending on how we want to control the environment.

It cannot be overstated as to the importance of this relationship. Now, certainly those individuals that live in areas were heating is not required, we can only sit back, green with envy. In an effort to compliment this relationship, there are a number of control strategies which are used. All of these strategies maximize the effectiveness of being able to keep our occupants comfortable. But further review of this scenario has far reaching aspects which are associated with this relationship. They must be appreciated to understand the reason why we need to supplement the heating or cooling.

So, why is it that we need to heat or cool in the first place? Well, as weather and temperature changes occur outside of a structure, similar changes within the structure take place at different rates. It is the R factor, or the resistance to the exchange of heat from hot to cold.

This relationship can be further described on a level we all can relate to, our morning coffee.

As you pour your coffee into your favourite mug or cup, consider the dynamics which make it cool enough for you to drink.

- What are the factors that influence the cooling rate of the coffee, or conversely how it is heating the localized area around the drinking vessel?
- Are you pouring into a paper cup?
- Does the paper cup have an insulating sleeve?
- Are you using a porcelain or stainless steal mug?
- Did you preheat the mug to minimize the immediate temperature drop?
- Are you one of ***those*** people that like to have milk or cream in their coffee?
- Have you calculated the temperature impact that this added dairy has on your coffee?

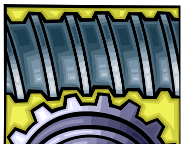
So, what do all of these considerations have to do with our topic at hand? It is the relationship of these factors which will impact the hot coffee cooling down, during the period of time that it is being consumed. The same aspects that apply to maintaining a consistent room temperature also apply to your coffee.

So, how do you prevent your coffee from cooling down? To start with, by increasing the ambient room temperature to a point where there is no temperature exchange is a start, but far from practical.

While we can try to minimize the heat gain/losses naturally, there becomes a point at which we need to "mechanically" overcome the heat/cool relationship. How do we do this?

Relationships Cont'd on page 3

Relationships Continued



Well, similar to the relationships discussed earlier, we now turn to how control operation impacts all of these aspects. The use of controls offers us a cornucopia of both passive and dynamic relationships. The controls require the input of information, control of output devices and processing logic to achieve a desired result.

The input of information into a control can take many forms. These are typically known as sensors or transducers. These are devices which operate directly on their own relationships which can be impacted by temperature, pressure, humidity, resistance, light, position, and more. With the advent of new technologies, input devices still operate on similar principals.

Sensors used with Viessmann controls, as well as many other manufacturers, use a type of sensor which changes resistance with the changing of temperature. The change of resistance is utilized within the control to provide the desired operation.

In the case of heating or cooling, it is about having a setpoint or desired value in comparison to an actual sensed temperature, which can be referred to as the reference value. If the actual or reference value is above or below the setpoint a cooling or heating function takes place.

Now that you have supplemental heating or cooling operation, what are the many mechanical factors/ relationships that impact the distribution in a typical boiler system.

- Are the pumps running and have they been sized properly for flow and head?
- Has the piping been cleaned out before operating the system?
- Was that underground piping insulated, or did somebody want to spend the money on the imported Italian hand painted bathroom sink?
- Lastly, how about the expansion tank, was it installed on the discharge or suction side of the pump?

These are only a small number of considerations which impact the operation, but, maybe some of which you have potentially experienced and had to diagnose when things didn't work.

Assuming that everything is operating as it should, a defined beginning and an end can be viewed providing a full circle. The boiler generates the heat. The boiler pump may pump it to a hydraulic separator. Assuming that the flows are just *SO,* to allow heat to be picked up from the separator to the distribution system, then we are able to supply the radiators or radiant floor with heat. There is a temperature drop across the heating zone which causes the return water to be cooler than when it left the boiler. The heat dissipated in the zone also elevates the room temperature. As the room temperature increases, the setpoint can now be satisfied and the operational principal can start over at the beginning. Now don't forget to provide a good helping of time in there for all of these relationships to work.

Similar to the movie that references the whole circle of life thing, the relationships of an operating mechanical system or any other cyclical operation, can be likened to that of a spinning bicycle wheel. The rim, spokes and hub are all supporting each other and all it takes is for one person to jam a stick into the spokes to create all sorts of new relationships.

Communication Cont'd from page 1

DHW functions, boiler status information and a host of other functions.

Now, you may be asking yourself, "*Well, that is fine and dandy, but what if I want to control the operation?*". Due to the design nature of the controls using LON to communicate, it is possible to integrate and access the information from within the control.

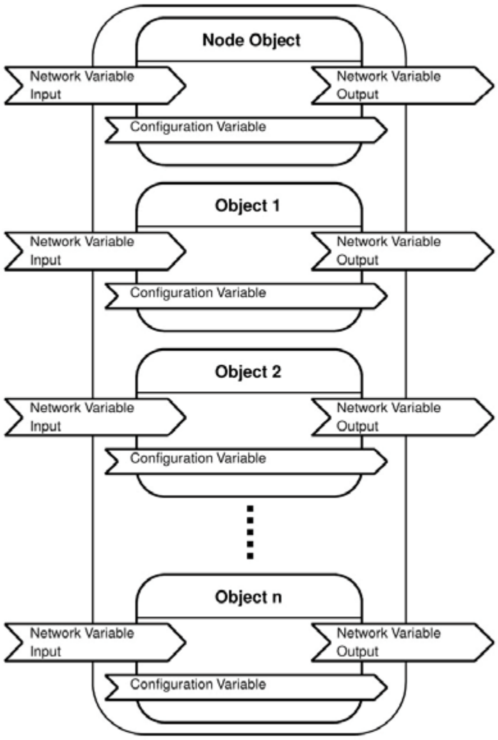
Over the years, the assumption was made that since communication is *open*, all information was available. This is simply not true and we will show you here, why that is.

Node Object

In the world of LON, each device is considered a "Node". Each Node has a Neuron chip which is essentially its brain. It controls all of the logic and communication functions. Portions of the Neuron are dedicated to the LON communication protocol as outlined by the manufacturer.

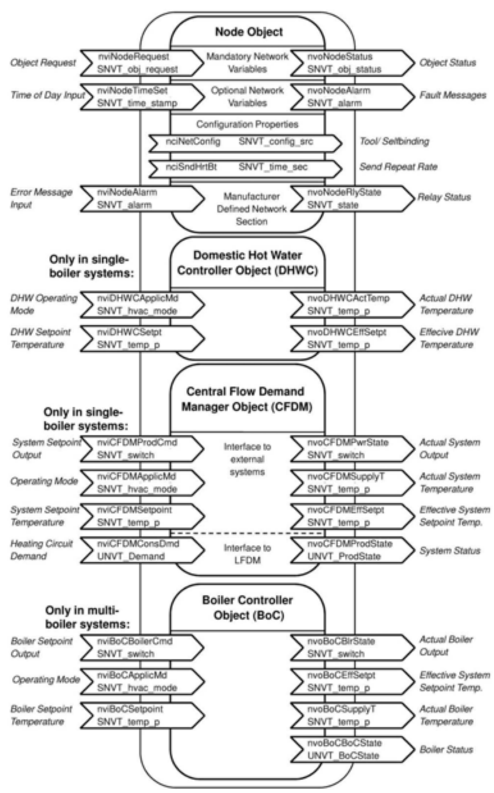
The structure of a Node, with respect to specific device functions such as fault reading, time of day or any of the communication attributes is called a Node Object. The control functions such as DHW, boiler or zone control functions are referred to as Functional Objects. One Node Object can contain multiple Functional Objects. It is the functional object which provides the operational information which is typically used to be displayed on the "front end" of the system.

The Node Object has three essential parts to it: Network Variable Inputs, Network Variable Outputs and Configuration Variables. All three of these are used in conjunction with one another to provide the information and operation that is required by other devices on the network.



Network Variable Inputs may be used by other device controller objects to provide setpoint information, commands or other functions in order to achieve the desired operation of a device or grouping of controls.

The linking of outputs from one Node Object to the inputs of other Node Objects is commonly referred to as "Binding". It is important to understand that one Network Variable Output can be connected to various Network Variable Inputs of multiple Node Objects. An example of this would be a LON enabled outdoor temperature sensor where the Network Variable Output is used to provide the outdoor air temperature to other devices to ensure they all share the same information.



Viessmann

To address our desire for information regarding the Viessmann control product, this is where we have to focus on the functional object of each control.

There are a number of pieces of documentation that should be referenced. The Viessmann LON Handbook and the NR2 Point Data Information are the best to start with. Both of these documents can be viewed from our website www.kwe-tech.com under the support link.

Vitotronic 100, GC1

To start this journey of discovery, let's begin with Vitotronic 100, GC1 control Node Object.

There are four essential objects for the GC1 control, they are: Node Object, Domestic Hot Water Controller Object (DHWC), Central Flow Demand Manger Object (CFDM) and Boiler Controller Object (BoC). Each of these has specific functions within the overall LON device. For our discussion here, the BoC Object will be referenced in a future issue discussing multiple boiler controls with Vitocontrol-S, MW1.

The Node Object section of the graphic shown here is the primary section of the GC1 control. It is responsible for the overall communication with the control. The remaining three objects are based on the operation of the control in single boiler systems or multiple boiler

Communication Cont'd on page 5

Continued from previous page

systems. Multiple boiler systems refers to the Autobinding operations with the Vitotronic 300-K Cascade control, otherwise known as the Vitocontrol-S, MW1.

Object Details

Let's breakdown the Node Object into the various parts. As we can see, there are input, output and configuration properties.

There are over 170 Standard Network Variable Types within the LONworks® protocol. These are typically called SNVT (Snivets) and of these, the Vitotronic 100, GC1 control uses about eight different types.

The second variable type is referred to as a UNVT. These are User Network Variable Types which unlike SNVTs are defined by the user instead of the "standardized" Snivet type. This allows manufacturers of devices to be able to provide control data/information outside of the standard "package" that is dictated by the LONworks communication protocol. In the case of the GC1 boiler control, the UNVT information is a function of multi-boiler systems when controlled by the Viessmann Vitocontrol-S, MW1 Cascade control.

Temperature and Setpoint

Let's examine both of the available SNVTs and UNVTs as they apply to the Vitotronic 100, GC1 control. The table below provides the same information as the Node Object graphic does, but only in a table format. The most common SNVT type is a SNVT_temp_p. This variable has essentially two functions in a GC1 control: to provide actual temperature information as well as setpoint temperature. This particular Snivet has an index number of 105 as referenced by the Echelon documentation. For all intents and purposes, it is the SNVT_temp_p variable when shown as a Network Variable Output which allows a temperature value to be communicated to a BMS or DDC system.

In terms of data structure, the SNVT_temp_p is a two byte size which refers to the length of the data string. Each byte represents eight bits equating to a total of 16 bits of information.

In the case of the GC1 control, there are only two temperatures that are available when communicating with the control: DHW and Boiler Temperature. By referencing any manufacturers' Node Object graphic, for any LON-enabled device, it is possible to confirm the temperatures and status points that are possible to be communicated from the control.

Reading a device's actual temperature output value is only one piece of the puzzle. Equally important is to know what the setpoints are and associated status information. With the Viessmann Node Object, a setpoint is also referenced as a SNVT_temp_p. Since a setpoint is an *input* variable, the object is a Network Variable Input. There is a specific Snivet (106) which is used for setpoint input, but the point in itself also references heat/cool functions with occupied, standby and unoccupied modes.

When writing a setpoint value to a GC1 control, referencing the Node Object provides us with a boiler temperature setpoint and a DHW temperature setpoint. Again, both of these are SNVT_temp_p variables with the object names *nviCFDMSetpoint* and *nviDHWCSetpt* respectively. The operation of the control will be based on these input values unless there are local control

Continued on following page

Input	Point	Object Name	Variable		Output	Point	Object Name	Variable
Node Object					**Node Object**			
Object demand	Node Request	nviNodeRequest	SNVT_obj_request		Object status	Node Status	nvoNodeStatus	SNVT_obj_status
Time input	Node Time Setup	nviNodeTimeSet	SNVT_time_stamp		Fault message	Node Alarm	nvoNodeAlarm	SNVT_alarm
Input fault message	Node Alarm	nviNodeAlarm	SNVT_alarm		Status controller outputs	Node Relay State	nvoNodeRlyState	SNVT_state
DHW Object					**DHW Object**			
DHW operating mode	DHW Controller Application Mode	nviDHWCApplicMd	SNVT_hvac_mode		DHW actual temperature	DHW Controller Actual Temperature	nvoDHWCActTemp	SNVT_temp_p
DHW setpoint temperature	DHW Controller Setpoint	nviDHWCSetpt	SNVT_temp_p		Effective DHW setpoint temperature	DHW Controller Effective Set-point	nvoDHWCEffSetpt	SNVT_temp_p
Central Flow Demand Manager (CFDM) Object					**Central Flow Demand Manager (CFDM) Object**			
System output setpoint	CFDM Production Command	nviCFDMProdCmd	SNVT_switch		Actual system output	CFDM Power State	nvoCFDMPwrState	SNVT_switch
Operating mode	CFDM Application Mode	nviCFDMApplicMd	SNVT_hvac_mode		Actual system temperature	CFDM Supply Temperature	nvoCFDMSupplyT	SNVT_temp_p
System setpoint temp.	CFDM Setpoint	nviCFDMSetpoint	SNVT_temp_p		Effective system setpoint temperature	CFDM Effective Setpoint	nvoCFDMEffSetpt	SNVT_temp_p
Heating circuit demand	CFDM Constant Demand	nviCFDMConsDmd	UNVT_Demand		System status	CFDM Production State	nvoCFDMProdState	UNVT_ProdState

Note: *This table is reflective of single boiler operation not utilizing the Viessmann cascade control*

Continued from previous page

setpoints which are set to a greater value. Both the local boiler setpoint and the DHW setpoint (and) can be altered on the control interface of the GC1 control. Refer to the individual control manual for information regarding this step.

Status Information

As reviewed earlier, the temperature and setpoint values are used to display the current operation of the control. Along with displaying the temperatures and setpoints, there is another aspect that is equally important and that is the status information. Like the SNVT_temp_p, the SNVT_state (83) Snivet consists of two bytes which equates to 16 bits which indicate ON or OFF functions of control outputs. These are referenced at the nvoNodeRlyState Snivet.

Bit	Logical Signal	100 GC1
0	DHW Production Pump	K
1	DHW Recirculation Pump	—
2	Heating Circuit Pump 1	—
3	Heating Circuit Pump 2	—
4	Heating Circuit Pump 3	—
5	Setback Contact HCP 1	—
6	Setback Contact HCP 2	—
7	Setback Contact HCP 3	—
8	Supply Pump	—
9	Primary pump heat exchanger set for DHW procution	K
	Pump for loading system	—
10	Boiler circuit or common supply pump	K
	Internal Pump	—
11	Shunt Pump	K
	Diverting valve in space heating position	—
12	Flue gas heat exchanger pump	X
13	ThermControl switching contact	K
	Diverting valve in DHW position	—
14	Burner Stage 1	X
15	Burner Fault	X
	Compiled fault message	—

Notes:
X = always applicable for this device
K = dependent on configuration of this device
— = not applicable for this device
The signals are "high active" i.e. a "1" means "contact closed" specifically "function activated"

Each individual bit is representative of an output function of the GC1 control. The table shown here provides a breakdown of the status information from a GC1 control. A similar table can be referenced for various other Viessmann controls to show similar information.

In the same way that temperature setpoints and actual temperature values can be included into the BMS/DDC system for operational display purposes, so can the status points from the table shown here.

Alarm Data

The Snivet information for alarms is comprised of 29 bytes of information. The control fault code is part of the data string which also includes time, date, Node ID and other specific information that may be used in diagnosis of the fault. The most important part of this structured data string is byte 28. This particular byte is a Hexadecimal value which can be cross-referenced to the fault codes in the Vitotronic 100, GC1 control manual.

Modes and Switches

Until now, we have discussed the Snivet points which are primarily referenced to know both control information and control setpoints. There are two other Snivet points which can be used to control through an operational mode selection as well as virtual demand.

The SNVT_hvac_mode allows for a number of operational modes to be selected regarding the particular function of the control. The GC1 control has two functions which can be controlled by this Snivet point, the nviDHWApplicMd for the DHW operations and the nviCFDMApplicMd for the burner control.

The DHW mode selection allows for the control to be controlled either locally by the internal DHW setpoint or by the nviDHWCSetpt but only if the HVAC_HEAT mode selection is used. The complete disabling of the DHW function can be accomplished with the HVAC_OFF mode. The implementation of these functions in the field have everything to do with being able to satisfy a desired control strategy with this direct LON communication to the control.

The burner function of the GC1 control can also be impacted by mode selection. There are five operational modes in total, HVAC_AUTO, HVAC_MRNG_WM_UP, HVAC_OFF, HVAC_TEST and HVAC_EMERG_HEAT.

These operational modes allow various control operations with the GC1 via the direct LON connection. Since the GC1 is effectively a setpoint control to maintain a desired boiler water temperature, along with DHW functionality, it is easy to influence the operation. There are no timer schedules to consider for occupied or unoccupied operation.

The first mode is the HVAC_AUTO which allows the standard operation with the boiler and DHW setpoint selection which can be altered on the front of the control. If the control has a coding card for a Vitorond boiler, minimum temperature protection is part of the operation of the control.

The HVAC_MRNG_WRM_UP mode ignores any of the control's setpoint functions as well as the digital input demands connected to the 143 or 146 plugs. Minimum boiler water temperature is maintained.

A complete shut down of the boiler can be accomplished with the HVAC_OFF mode selection. All internal demands, external digital inputs and demand from nviCFDMSetpoint are ignored.

Continued on following page

Continued from previous page

Minimum boiler water temperature is not maintained.

The remaining two modes allow for an external demand of the burner. The HVAC_TEST mode will enable the burner and keep the burner at low fire. By switching the mode to HVAC_EMERG_HEAT, the burner, if not already demanded, will be driven to high fire.

Switch

While providing mode changes to the boiler control may be handy, sometimes all that is necessary is to demand the burner ON and ask for a specific modulation %. This can be accomplished by utilizing the nviCFDMProdCmd. This Snivet type is a switch. This function takes priority over all other methods of control that are available.

Depending on the control/ integration software package that is being used, there should be a state and a value which is used to provide control. There are three states, StateNul, StateON and StateOFF or –1, 1 and 0 respectively, depending on how this is displayed.

When creating an ON demand of the control/burner, the state would be changed to StateON. A burner modulation/stage value will be set either as a percentage 0-100% or from 0-200 in 0.5% intervals. As the burner value is increased, the burner will modulate up and conversely as the value is decreased, the burner will modulate down.

Changing the state to StateOFF, the burner will shut off, but best practice is to modulate the burner down before turning it off completely. This is done to avoid any temperature stacking or stresses caused from excessive boiler water temperature.

Lastly, returning to StateNul will allow "automatic" operation of the boiler control with respect to any internal setpoint DHW or boiler demands.

Summary

What do we know at this point?

- Actual Boiler Water Temperature is nvoCFDMSupplyT
- Boiler Water Setpoint is nviCFDMSetpoint
- Actual DHW Temperature is nvoDHWCActTemp
- DHW Setpoint Temperature is nviDHWCSetpt
- Alarm information is nvoNodeAlarm
- Control Status Information is nvoNodeRlyState
- Remote Demand Control can be accomplished with nviCFDMConsDmd OR nviCFDMProdCmd

We also know that the Node Object provides us with all of the details that we need to know regarding the information that can be accessed from the boiler control. However, what is paramount is the integration of the control by those individuals that are responsible for either meeting the specifications outlined by specific job requirements or actually reviewing the information that is required.

Working with the control and integrating it to a BMS/DDC system also requires putting the control into a Toolbinding function. Details of this function and many other resources can be found at www.kwe-tech.com

Look for future issues of this newsletter to cover this topic in more detail.

Resources (www.kwe-tech.com)
NR2 LON Handbook
Tridium Commissioning Guide
Automated Logic Setup Guide
LON Data Points

Panel of the Month

Four floor-standing panels awaiting shipment

Doors open for a good look

Control panels ready for installation. Include VFD drives, touch screens, heavy duty copper distribution headers at the top of the panel, cooling vents and motors, full compliment of motor starters, overloads and fuse blocks.

A convenient door-mounted document holder allows for all important paperwork to be stored where it belongs including the 234 page schematic!

How many would you like?

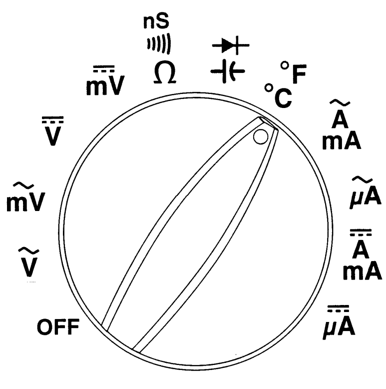
Multimeter Basics

Possibly the most underrated, misunderstood and neglected tool in the service persons arsenal is the Electronic Multimeter. In recent years the Multimeter has been replaced with the “idiot light”. This is the tool that tells you “yep, ya got juice!”, by illuminating when you bring it near a current carrying conductor. Yes, this tool does have its place, but the likelihood that a misdiagnosis will occur is much greater than when taking an actual measurement. It’s what this tool doesn’t tell you that matters.

A good meter can be had nowadays for not a lot of money. Most every large hardware/home improvement store will have a selection covering all price ranges. Once you have made your selection, use it and trust it.

A good basic meter should have the ability to measure four basic areas of concern: AC Voltage, DC Voltage, Current and Resistance.

In the past, most meters had specific ranges of operation. More and more meters today have an auto ranging function. This prevents the user from having to select or worry about different operating ranges when measuring Voltages. Just simply touch the test leads to the device and presto.



Sample Multimeter dial

Voltage
ALWAYS USE CAUTION WHEN WORKING ON LIVE CIRCUITS!
Most meters use symbols to reference to specific options. The most common is the letter V with a wavy line above it. This wavy line is a symbol for alternating current. It is an indicator of a sine wave. When this is selected on the front of the meter, all AC voltage measurements are possible.
A letter V with a solid line and dotted line under the solid line is an indicator of DC voltage. A direct current measurement DC is now possible.

Smaller AC and DC voltages may need a specific setting on the meter. Depending on the meter quality, it may not be possible to measure very small voltages. Some meters may just show the voltage as a decimal point shift instead of having a specific range.

Current
Current measurement with the meter is similar to that of Voltage. Select the current setting depending on whether AC or DC current. Most meters require the user to make a test lead change when measuring current. This generally entails moving the red test lead from one position to another. The plugs are colour coded red and black to help avoid incorrect connections.

The meter settings use the same symbols for current as voltage. The only difference is that it may not be necessary to make a selection for small current measurements and large current measurements. Small current measurements such as microamps (μA) may not necessarily be measurable on some meters. A decimal point shift may allow the user to read a basic measurement. Only a meter with a μA setting will give you a precise display of the current measurement. The flame ionization signal is only possible with meters that can measure μA currents.

Resistance
This measurement selection (W) allows the user to test continuity and resistance. This is very useful when checking for short circuits, fuses and tracing wires.

Temperature
Some models of multimeters now have the ability to measure temperature by plugging in an optional thermocouple like the test leads that come with the unit. This is handy as it combines a lot of functions into one unit.

Bells and Whistles
Try to stay away from units which are needlessly feature packed. Buy better quality first and foremost, however having a remote display module comes in handy like a Fluke model 233.

Trademark Information

K-W Electronic Service Inc.
KWE Technologies Group
750 McMurray Road
Waterloo, Ontario, Canada
Tel: 519-747-5042
Fax: 519-747-4448
Web: www.kwe-tech.com
Emails us at:
admin@kwe-tech.com
support@kwe-tech.com
info@kwe-tech.com
office@kwe-tech.com
sales@kwe-tech.com

Any feedback regarding our newsletter or any questions regarding its content, please email jeff@kwe-tech.com.