

# WBK15 - 5B Isolated Signal-Conditioning Module

[Description ..... 1](#)

[Hardware Setup ..... 2](#)

[Configuration ..... 2](#)

[Connection ..... 3](#)

[Power ..... 4](#)

[Safety Concerns ..... 4](#)

[Using Splice Plates to Stack Modules ..... 4](#)

[Software Setup ..... 5](#)

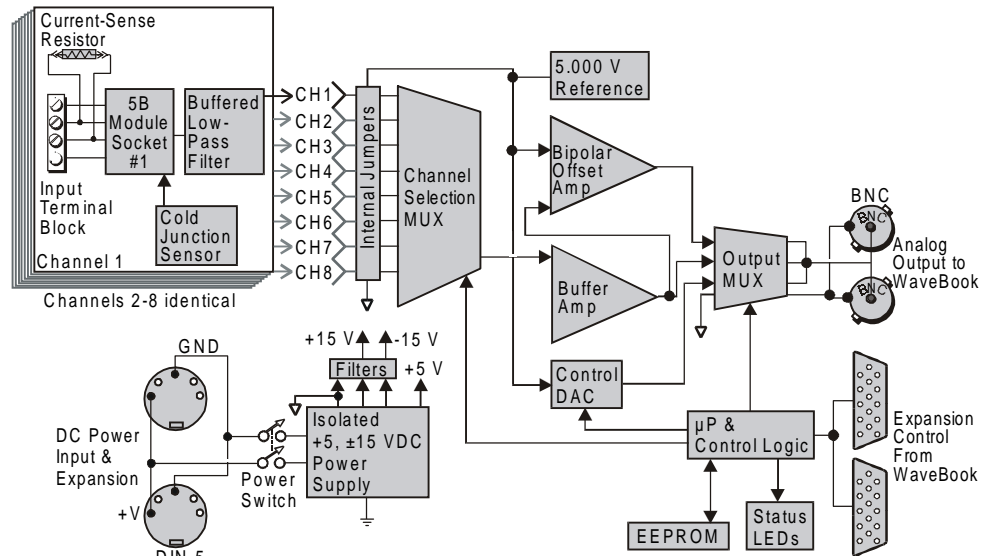
[WBK15 – Specifications ..... 7](#)

## Description

The WBK15 module can accommodate eight 5B isolated-input signal-conditioning modules for use with the WaveBook. The WaveBook can accommodate 8 WBK15s for a maximum of 64 expansion channels. The WaveBook scans WBK15's channels at the same 1  $\mu$ s/channel rate that it scans all WBK analog inputs, allowing it to measure all channels of a fully configured 72-channel system in 72  $\mu$ s.

Other features of WBK15 include:

- Built-in power supply that operates from 10 to 30 VDC and can power a full complement of 5B modules (even with bridge excitation).
- Removable, plug-in screw-terminal blocks for convenient connection of 5B modules.
- On-board cold-junction sensing for thermocouple 5B modules.
- For each 5B module, 1500 V isolation from the system and from other channels.



WBK15 Block Diagram

# Hardware Setup

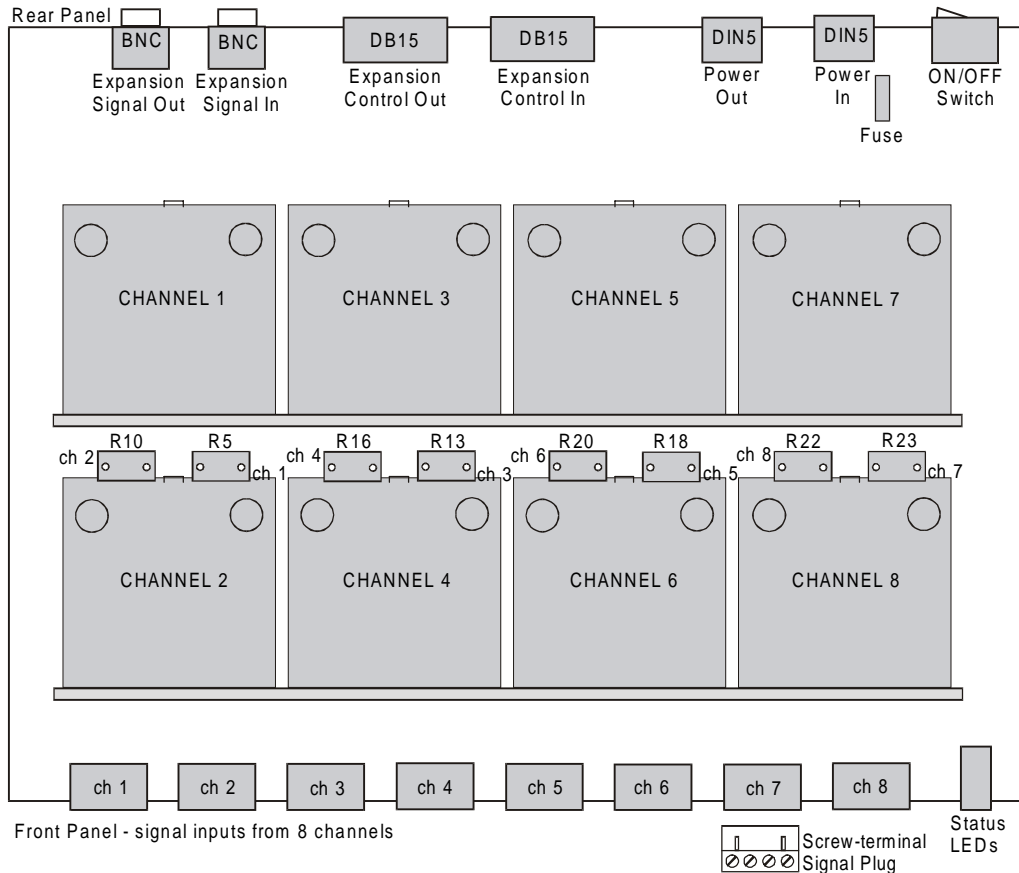
## Configuration

The next figure shows the board layout within a WBK15. Note the channel-number layout for the 5B modules and the location for plug-in current-sense resistors.



**Only current-input type modules require the plug-in resistors.**

**The plug-in resistors must be removed for all other module types.**



WBK15 Board Layout

### Installation of 5B Modules

#### WARNING



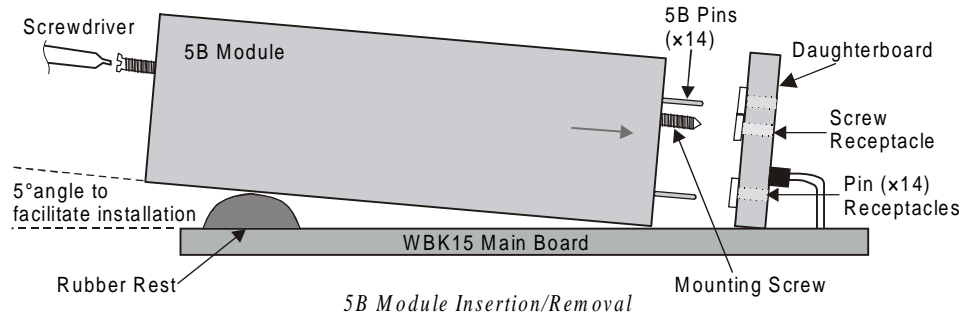
**Electric shock hazard! Turn off power to WBK15 and all connected modules and devices before inserting or removing modules. Failure to do so could lead to injury or death due to electric shock.**

#### CAUTION



**Handle the 5B module carefully while inserting pins into the daughterboard. Do not over-tighten mounting screw.**

The 5B modules plug into a daughterboard (×2) on WBK15's motherboard. Rubber bumpers on one side and a tilted daughterboard allow the module to rest at a 5° angle to facilitate insertion and removal. The adjacent daughterboard has a cut-a-way to allow room for a screwdriver (see figure).



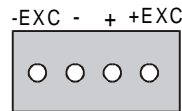
## Connection

WARNING



**Electric shock hazard! De-energize circuits connected to WBK15 before changing the wiring or configuration. Failure to do so could lead to injury or death due to electric shock.**

Signals are connected by screw-terminal signal plugs that plug into the 4-pin jacks on WBK15's front panel (see figure).

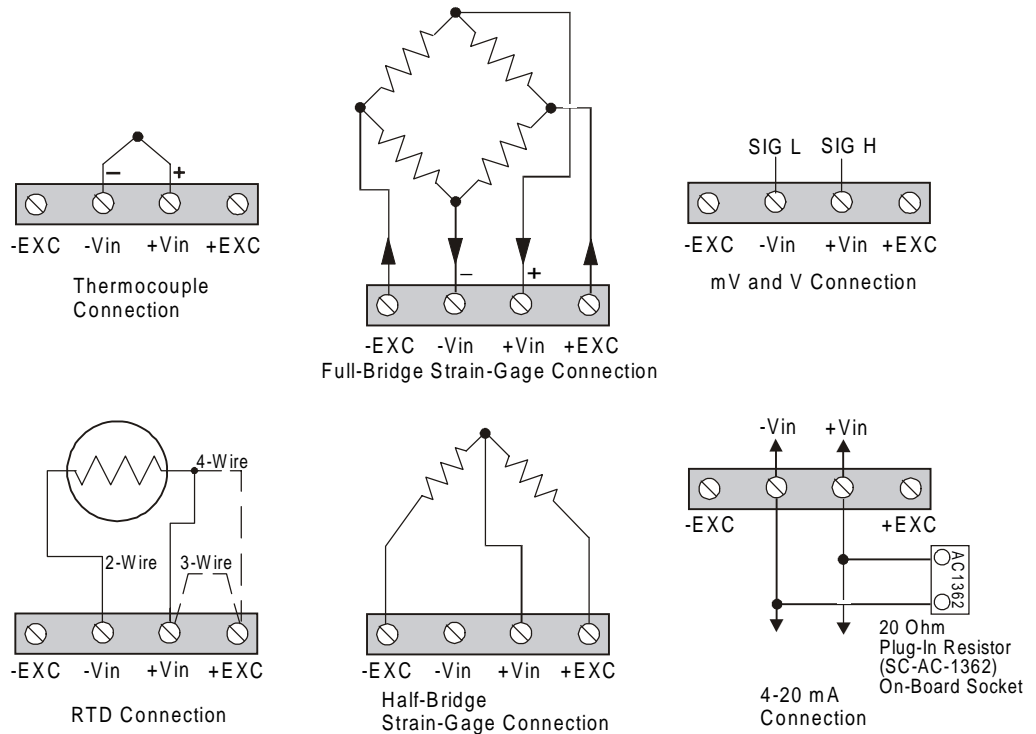


- EXC Negative excitation output - only used on strain-gage type modules
- Negative signal input
- + Positive signal input
- +EXC Positive excitation output - only used on strain-gage type modules

*Signal Connection Jacks (per channel)*

Input signals (and excitation leads) must be wired to the plug-in terminal blocks. Eight 4-terminal blocks accept up to 8 inputs.

Terminal blocks are connected internally to their corresponding signal conditioning module. The terminal blocks accept up to 14-gage wire into quick-connect screw terminals. Each type of input signal or transducer (such as a thermocouple or strain gage) should be wired to its terminal block as shown in the figure below. Wiring is shown for RTDs, thermocouples, 20mA circuits, mV/V connections, and for full- and half-bridge strain gages.



*Typical Signal Connections*

## Power

Like the WaveBook, WBK15 contains an internal power supply. The unit can be powered by the included AC power adapter or any 10 to 30 VDC source, such as a 12 V car battery. For portable or field applications, WBK15 and the WaveBook can be powered by the DBK30A rechargeable battery module or DBK34 vehicle UPS module. The supply input is fully isolated from the measurement system. If the fuse requires replacement, it is a 2 A fuse (Littelfuse #251002).



**Prior to daisy-chaining from one module's power connector to another, be sure to compute the power consumption for the entire system. Some modules may need independent power adapters. Chapter 3 contains detailed information regarding power supply issues.**

## Safety Concerns

### WARNING



**Shock Hazard! Voltages above 50 Vrms AC and voltages above 100 VDC are considered hazardous. Safety precautions are required when 5B modules are used in situations that require high-voltage isolation from the rest of the system. Failure to practice electrical safety precautions could lead to injury or death.**

WBK15 is specified for 1500 VDC isolation in a normal environment free from conductive pollutants and condensation. The 1500 VDC rating requires a proper earth ground connection to the chassis and treatment of adjacent inputs as potentially hazardous. CE-marked units used in the European community are rated at 600 VDC isolation. The 600 VDC CE isolation specification is based on a double insulation requirement, and no earth ground is required.

Input cables must be rated for the isolation potential in use. Line voltage ratings are much lower than the DC isolation values specified due to transients that occur on power lines. Never open the lid unless all inputs with potentially hazardous voltages are removed. The lid must be securely screwed on during use.

Some things to remember:

- Before closing up an open WBK15, ensure no foreign objects are inside.
- Properly tighten all chassis screws before system use.
- Properly tighten the screw that retains the 5B module.
- Never plug in or unplug potentially hazardous connections with power applied to any connected equipment.
- Never attempt to change 5B modules or open the lid with power applied to the WBK15. You could short out internally exposed circuits and cause personal injury or equipment damage.



#### Reference Note:

Refer to chapter 3 for detailed information regarding power aspects of WaveBook systems.

## Using Splice Plates to Stack Modules

For convenient mounting, the WBK15 has the same footprint as other WBK modules and WaveBooks. Splice plates provide a means for stacking WaveBooks and modules. Screw-on handles are available for portable applications. Refer to chapter 3 for assembly information.



**When using WBK17 modules in conjunction with other WBK modules, the WBK17 modules must be located closest to the WaveBook/516 due to the CA-217 cable length. The order of the other WBK modules does not matter.**



**Splice plates will partially block the vents on WBK16s and WaveBook/516s when stacked. This partial blocking of vents does not jeopardize the cooling process.**

## Software Setup

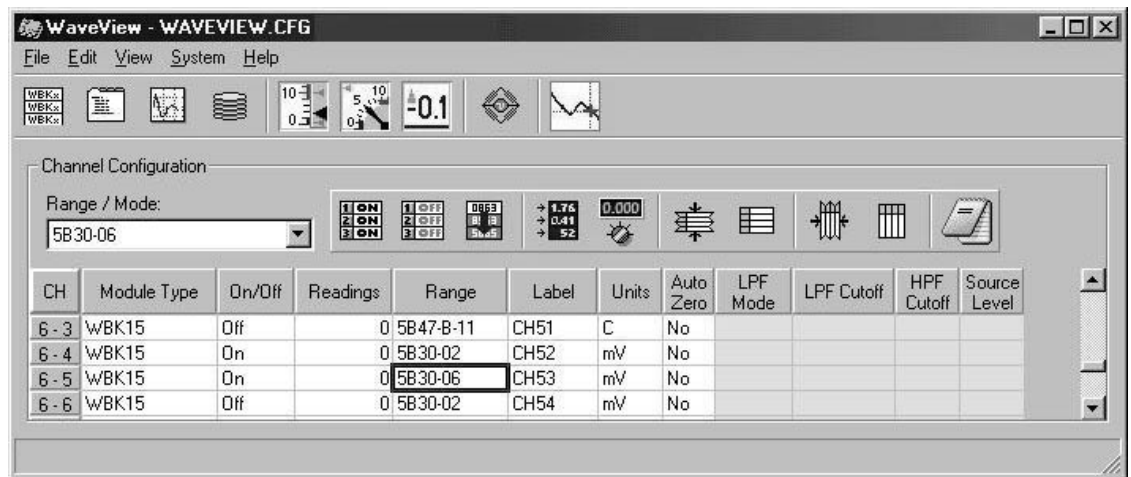
You will need to set several parameters so WaveView can best meet your application requirements. For software setup information, refer to the "Software Setup" section in chapter 3. For detailed WaveView information, refer to the *WaveView Document Module*.

After the 5B module type is identified, WaveView figures out the  $m$  and  $b$  (of the  $mx+b$  equation) for proper engineering units scaling. An example of the  $mx + b$  equation follows shortly.



### Reference Notes:

- For software setup information, refer to "Software Setup" in chapter 3.
- For detailed *WaveView* information, refer to the *WaveView Document Module*.
- The API does not contain functions specific to WBK15. Refer to related material from the *Programmer's Manual* (p/n 1008-0901) as needed.



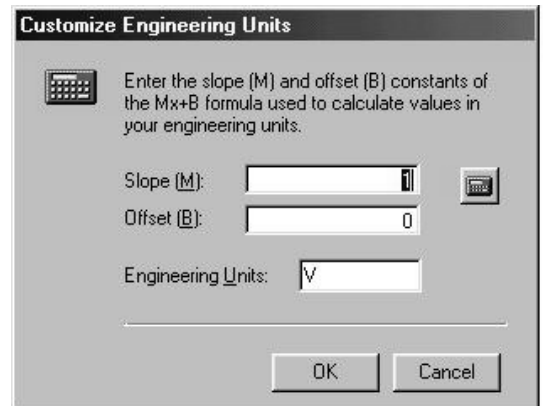
WaveView Configuration Main Window

### $mX + b$ , an Example

The *Customize Engineering Units* dialog box can be accessed via the *WaveView Configuration main window* by activating the **Units** cell [for the desired channel], then clicking to select  $mX+b$ .

From the *Customize Engineering Units* dialog box (see figure at right), you can enter values for  $m$  and  $b$  components of the equation that will be applied to the data. There is also an entry field that allows you to enter a label for the new units that may result from the  $mX+b$  calculation.

An example of  $mX + b$  equation use follows.



## Engineering Units Conversion Using $mx + b$

Most of our data acquisition products allow the user to convert a raw signal input (for example, one that is in volts) to a value that is in engineering units (for example, pressure in psi). The products accomplish this by allowing the user to enter *scale* and *offset* numbers for each input channel, using the software associated with the product. Then the software uses these numbers to convert the raw signals into engineering units using the following “ $mx + b$ ” equation:

$$\text{Engineering Units} = m(\text{Raw Signal}) + b \quad (1)$$

The user must, however, determine the proper values of *scale* (**m**) and *offset* (**b**) for the application in question. To do the calculation, the user needs to identify two known values: (1) the raw signal values, and (2) the engineering units that correspond to the raw signal values. After this, the scale and offset parameters can be calculated by solving two equations for the two unknowns. This method is made clear by the following example.

### Example

An engineer has a pressure transducer that produces a voltage output of 10.5 volts when the measured pressure is 3200 psi. The same transducer produces an output of 0.5 volt when the pressure is 0 psi. Knowing these facts, m and b are calculated as follows.

**A - Write a pair of equations, representing the two known points:**

$$3200 = m(10.5) + b \quad (2)$$

$$0 = m(0.5) + b \quad (3)$$

**B - Solve for m by first subtracting each element in equation (3) from equation (2):**

$$3200 - 0 = m(10.5 - 0.5) + (b - b) \quad (4)$$

Simplifying gives you:  $3200 = m(10) \quad (5)$

This means:  $m = 320 \quad (6)$

**C - Substitute the value for m into equation (3) to determine the value for b:**

$$0 = 320(0.5) + b \quad (7)$$

So:  $b = -160 \quad (8)$

Now it is possible to rewrite the general equation (1) using the specific values for m and b that we just determined:

$$\text{Engineering Units} = 320(\text{Raw Signal}) - 160 \quad (9)$$

The user can then enter the values of m and b into the appropriate location using the facilities provided by compatible data acquisition software, for example: WaveView, DaqView, Personal DaqView, LogView, and TempView. The software uses equation (9) to calculate signal values in engineering units from that point on.

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## WBK15 – Specifications

**Name/Function:** WBK15 Multi-Purpose Isolated Signal Conditioning Module

**Connectors:** 2 BNC connectors, mate with expansion signal input on the WaveBook/512;  
two 15-pin connectors, mate with expansion signal control on the WaveBook/512

**Module Capacity:** Eight 5B modules (optional) *See latest catalog or contact your sales representative in regard to the types of 5B Modules available for your application.*

**Input Connections:** Removable 4-terminal plugs (Weidmuller type BL4, PN 12593.6,  
or type BLTOP4, PN 13360.6)

**Power Requirements:** 10 to 30 VDC, or 120 VAC with included adapter

**With 8 thermocouple-type modules:** 12 VDC @ 0.25 A, 15 VDC @ 0.20 A, 18 VDC @ 0.2 A

**With 8 strain-gage-type modules:** 12 VDC @ 0.95 A, 15 VDC @ 0.75 A, 18 VDC @ 0.65 A

**Cold-Junction Sensor:** Standard per channel

**Shunt-Resistor Socket:** One per channel for current loop inputs

### Isolation

**Signal Inputs to System:** 1500 VDC (600 VDC for CE compliance)

**Input Channel-to-Channel:** 1500 VDC (600 VDC for CE compliance)

**Power Supply to System:** 50 VDC

**Dimensions:** 221 mm x 285 mm x 36 mm (8.5" x 11" x 1.375")

**Weight:** 1.8 kg (4 lb) [with no modules installed]

