

# Mapping Temperature Inputs to Analog Outputs

When a temperature is the source and 4–20 mA is the destination, the configuration *requires* the definition of the null and the span parameters. The Null and Span parameters are used to associate temperature values to the range of 4–20 mA values. The Null value is the temperature that represents 4 mA and Span is the range of temperature values that will be mapped to the 4 to 20 mA outputs.

The Null and Span parameters only become available on the User Configuration Tool screen after dissimilar I/O types are mapped to each other, for example, mapping a temperature input to an analog outputs. For similar analog I/O types, leave the Null and Span values at the 0.0 defaults.

## EXAMPLE 1: MAPPING TEMPERATURE INPUTS FROM NODE INPUT TO GATEWAY OUTPUT

When mapping temperature inputs to analog outputs, the null value is the starting temperature to be associated with 4 mA. The span is the entire temperature range that is to be associated with 4–20 mA.



In our sample network, Node 1 is a temperature/relative humidity Node that measures temperatures ranging from –20° to 130° F. The Gateway has four discrete inputs and outputs and two analog inputs and outputs. We want to map the temperature and relative humidity inputs from Node 2 to analog outputs on the Gateway.

To map an input temperature range from –20° to 130° to a 4 to 20 mA output, set the null value to –20 and the span to 150. Setting the null value to –20 establishes a starting point of –20° associated to 4 mA. Setting the span to 150 defines the range associated with 4 to 20 mA. All temperatures between –20° and 130° will correspond to a proportional value between 4 mA and 20 mA.

Register View | Device Config | **I/O Linking** | System Parameters | Master Mode | Setup | Help

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Source: Node 1

Source			Destination									
Device	I/O	Type	Device	I/O #	Type	Null	(units)	Span	(units)	Default Output	(units)	Hold Last State
Node 1	1	Rel. Humidity	Gateway	14	4-20 mA	0.0	RH	100.0	RH	0.0	RH	<input type="checkbox"/>
Node 1	2	°C	No Link	--	None	0.0	--	0.0	--	0.0	--	<input type="checkbox"/>
Node 1	3	°F	Gateway	13	4-20 mA	-20.0	°F	150.0	°F	0.0	°F	<input type="checkbox"/>
Node 2	4	Discrete	No Link	--	None	0	--	0	--	0	--	<input type="checkbox"/>
Node 2	5	Discrete	No Link	--	None	0	--	0	--	0	--	<input type="checkbox"/>
Node 2	6	Discrete	No Link	--	None	0	--	0	--	0	--	<input type="checkbox"/>
Node 2	7	Raw Value	No Link	--	None	0	--	0	--	0	--	<input type="checkbox"/>
Node 2	8	Raw Value	No Link	--	None	0	--	0	--	0	--	<input type="checkbox"/>

Set the null value to be the starting temperature and set the span to be the entire range of temperatures. In this example, the null is –20 and the span is 130 – – 20 = 150.

To verify your values, null + span should equal the temperature you want to associate with 20 mA, in this case, 130°.

# EXAMPLE 2: MAPPING MULTIPLE TEMPERATURE INPUTS TO GATEWAY AND DX85 OUTPUTS



A more complicated example of mapping temperature inputs to analog outputs involves mapping multiple temperature inputs to a Gateway and DX85 without using a host system. To do this, we use a DX85 with four analog outputs connected via serial RS-485 to the Gateway. As in the previous example, we will be measuring temperatures between  $-20^{\circ}$  and  $130^{\circ}$  F using a temperature/humidity sensor connected to a Node with Serial Interface.

Step 1. Configure the DX85's analog outputs to translate temperature values.



- Set the rotary dials on the DX85 to Slave ID 01.
- Plug the DX85 into the RS-485 to USB converter cable. The User Configuration Tool still displays that the device plugged into the cable is a "Gateway," even though it is the DX85 plugged in.
- Use the Device Config, Device Parameters screen to configure each of the DX85's outputs' threshold and hysteresis parameters (Analog outputs 1 through 4 are I/O points 9 through 12). Enter the null value into the threshold parameter and click the Send button. Enter the span value into the hysteresis parameter and click the Send button.
- Disconnect the DX85 from the converted cable.
- Reset the DX85's Slave ID back to 02.

Register View **Device Config** I/O Linking System Parameters Master Mode Setup Help

Device Parameters **Device Information** Device Restore Site Survey Load/Save

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**Device Parameters**

Show Value as:  Integer  Hexadecimal Get Send

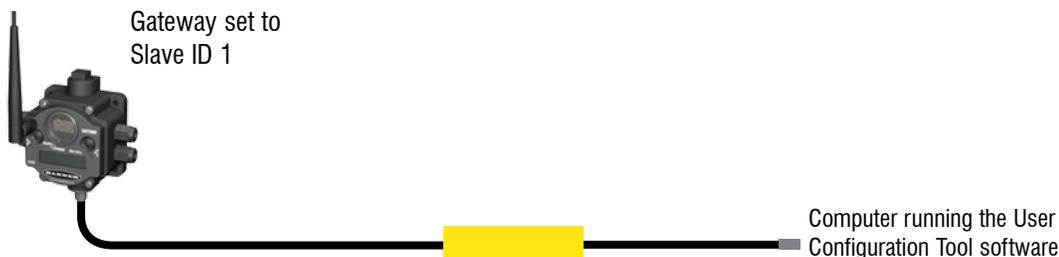
Device	I/O Number	Parameter	Value
Gateway	9	Threshold	-20

**Threshold (bits 15:0).** The trigger point or threshold for an analog input. When an analog input is greater than or equal to the threshold value, a ON or 1 event is reported (if not inverted). If the analog input does not reach the active threshold value, no change of state is reported. If the threshold parameter is 0, there is no threshold and the analog input will report based on the delta rate. Value range: 0 (disable, default) through 65535 (two-byte value). (Parameter number 0x08).

Supported in Gateway RF Firmware Version 2.7 and above.  
Supported in Node RF Firmware Version 1.0 and above.

When the DX85 is set to Slave ID 01 and plugged into the UCT software, the UCT "recognizes" it as the "Gateway."

Step 2. Configure the Gateway for I/O linking.



- Set the Gateway's Slave ID to 01.
- Plug the Gateway RS-485 to USB converter cable.
- As shown in Example 1, use the I/O Linking screen and the Null/Span parameters to map the selected temperature and relative humidity from one of the Nodes (we're using Node 1) to the Gateway's outputs.

Step 3. When communicating with an external Modbus slave, such as the DX85, without a host system, use the Modbus Master capability of the Gateway. Using the Master Mode screen, map the remaining temperature and relative humidity values from Nodes 2 and 3 to outputs on the DX85. After making the necessary changes, click the Send button to write these changes back to the Gateway.

The Master Mode screen uses the following parameters:

Register View | Device Config | I/O Linking | System Parameters | **Master Mode** | Setup | Help

DX8x is Modbus RTU Slave (default)  
 DX8x is Modbus RTU Master

Master Timeout: 90 | Change Mode

Get | Clear | Send

Map #	Local Register	Action	Remote Type	Remote Register	Slave ID	Poll Timeout ms
1	33	Writes To	Holding Regis	9	2	450
2	35	Writes To	Holding Regis	10	2	450
3	49	Writes To	Holding Regis	11	2	450
4	51	Writes To	Holding Regis	12	2	450
5	0	None	None	0	1	450
6	0	None	None	0	1	450

Maps Node 2 inputs 1 (RH) and 3 (temp) to the DX85 outputs 1 and 2.

Maps Node 3 inputs 1 and 3 to the DX85 outputs 3 and 4.

- Map Number. An index into the master table.
- Local Register. Defines the Modbus register within the Gateway master device and wireless system. Refer to the register tables listed in the device datasheets.
- Action. Defines the operation performed between the registers on the master and slave device. *Read From* sets the master to read from the remote slave register and copies the result into the local register. *Write To* writes the local register contents to the remote slave register. Select None if the table entry is empty.
- Remote Type. Defines the data type in the remote slave device. DX80 devices use Holding Registers.
- Remote Register. Defines the slave device register to read/write. Refer to the appropriate datasheets.

In the example network shown, we have mapped the following

- Node 1's inputs 1 and 3 to the Gateway's outputs 1 and 2 using the UCT's I/O Linking screen (Example 1)
- Node 2's inputs 1 and 3 to the DX85's outputs 1 and 2 using the UCT's Master Mode screen
- Node 3's inputs 1 and 3 to the DX85's outputs 3 and 4 using the UCT's Master Mode screen

Step 4. With the Gateway still plugged into the adapter cable, change the operational mode to **DX8x is Modbus RTU Master**. Click the Send button. Disconnect the Gateway from the USB/RS-485 adapter cable.

Register View | Device Config | I/O Linking | System Parameters | **Master Mode** | Setup | Help

DX8x is Modbus RTU Slave (default)  
 DX8x is Modbus RTU Master

Master Timeout: 90 | Change Mode

Get | Clear | Send

Step 5. Connect the DX85 (Slave ID 2) to the Gateway (Slave ID 1) using the splitter cable.

