

# Creating New Waveforms

Application Note S0 - September 22, 2021

Creating a new waveform consists of a few steps. First, open the *HxRGWaveforms.c* file and create a new named 32-bit array, which should be marked with the `const` keyword to prevent other parts of the micro-controller code from changing its value(s). Note that no two arrays can have the same name.

The following example creates a new empty waveform array called `CLOCK_COL`:

```
const uint32_t CLOCK_COL = {};
```

Now fill in the operations of the waveform array. Each line in the array typically starts with a delay, followed by one or more clock signals; that are defined near the top of the *HxRGWaveforms.c* file. In addition, new signal definitions can be added to the file as needed. The delay value represents the amount of time before the next line in the array is executed by the waveform generator and is calculated as 20ns times any 16-bit value plus an additional 20ns for the waveform generator write time. For example, the definition for a 100ns delay in the *HxRGWaveforms.c* file is defined as 20ns times 4, which is 80ns. Adding the additional 20ns for the waveform generator write time we get 100ns.

This example shows the clock column waveform array:

```
const uint32_t CLOCK_COL[] =
{
    DLY_100nS | CLK | HCLK | 0000 | LSYNCB | FSYNCB,
    DLY_100nS | VIDEO | XFER | ADC,
    DLY_100nS | VIDEO | 0000 | 000,
    DLY_100nS | CLK | 0000 | 0000 | LSYNCB | FSYNCB
};
```

Next, define and connect the new waveform array to a waveform object of type `waveform_t` using the `NEW_WAVEFORM` macro found in the base library header *ArcWaveforms.h*. The macro takes the name of a waveform array and returns a `waveform_t` object that will contain a pointer to the array data along with the count of the number of elements in the array.

The following example creates a new `waveform_t` object and assigns the `CLOCK_COL` array to it:

```
waveform_t CLOCK_COL_WAVEFORM = NEW_WAVEFORM( CLOCK_COL );
```

Finally, add the address of the new waveform `CLOCK_COL_WAVEFORM` to the `WAVEFORM_LIST` array located in the *HxRGWaveforms.c* file. The location of the new waveform within the list makes no difference. The list and all of its data are loaded into the ARC-420 timing board waveform generator when the timing firmware file is loaded into the NXP from either the host computer or the on-board flash memory.

To use the waveform in other files, add an `extern` line in the *HxRGWaveforms.h* file. For example, the following adds access to the `CLOCK_COL_WAVEFORM` from any other file in the project that includes the *HxRGWaveforms.h* file.

```
extern waveform_t CLOCK_COL_WAVEFORM;
```