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RELEASE NOTES

(D)AARC5XX Series

Front End Firmware Release RMS1877-04-A

These release notes contain important information about the new firmware and how it will affect the performance of instruments in which it is installed. The notes outline functional enhancements, adaptive changes and, if applicable, problem corrections.

Please read this documentation carefully. References to pertinent sections in the product's user's guide are shown in square brackets.

Compatibility	*Host Firmware Required*	
	Full Compatibility	*Partial Compatibility (No access to items 1–2)*
DAARC500 (Gen2)	*≥ RMS11030-02-B*	*≤ RMS11030-02-A*
AARC500 (Gen-2)	*≥ RMS11029-02-B*	*≤ RMS11029-02-A*
AARC510	*≥ RMS11031-01-F*	*≤ RMS11031-01-E*
DAS500	*≥ RMS11035-01-A*	*N/A*
DAARC500 (Gen-1)	*N/A*	*RMS1936-02-G*
AARC500 (Gen-1)	*N/A*	*RMS1878-02-G*

1. New Front End transfer function.

   This is a new Transfer Function (TF) that can be customized to the requirements of a specific installation. For example, it can be configured to minimize the effects from the rotor system in a helicopter, or some other form of interference with known frequency characteristics.

   The new TF has been named *Custom2*. It is available only when the *Advanced Functions Option* is included, and applies to all products in the (D)AARC5XX series – DAARC500 (Gen-2), AARC500 (Gen-2), AARC510 and DAS500.

   Custom2 complements another form of customizable TF that has been available in the system for quite some time, *Custom1*. Together they offer powerful and flexible options. Custom1 is implemented using a generic structure that is very flexible. On the other hand, the design process to achieve the desired characteristics is fairly elaborate, and a large number of coefficients in binary (floating-point) format are required. Custom1 is also computationally demanding – some restrictions apply when high sampling rates are used.

   Custom2 is implemented using a structure which, while not as flexible as that of Custom1, is still quite powerful. The design process to achieve a desired characteristic is simple, and only a few parameters in ASCII format are required to set it up. Furthermore, the implementation of Custom2 is computationally very efficient.

The process to design and setup either one of the custom TFs is in general as follows –

a. The user should determine the characteristics required in the frequency domain. For example, establish the frequencies at which the TF should provide maximum attenuation. The high sampling rates and broad-bandwidth TFs available in the system are good tools to help in this process.

b. Once the requirements are established, consult with RMS Instruments to design a suitable TF.

c. The actual setup of the TF consists of the uploading of a series of commands and parameters directly into the Front End. This can be done easily at the Factory, or alternatively, RMS Instruments can provide the user with the command file and instructions for uploading.

In its factory-default form, Custom2 is configured as an FIR filter with very narrow bandwidth (1.3 Hz), 825-msec length, and excellent attenuation characteristics outside the pass-band. This TF significantly reduces noise levels relative to those achieved with the 'standard' TF (1.6 Hz bandwidth) typically used in survey mode. For example, with F_S=640 Hz and F_{SH}=10 Hz, noise levels, as measured by the standard deviation of the fourth difference, are reduced by some 35%. (Note the trade-off in terms of the integration time: 825 msec for Custom2 vs. 625 msec for the standard TF.)

[User's Guide: Sections 3.4.1.1c and 4.3]

2. Gating magnetometer measurements for simultaneous use with EM systems.

Some applications may require the simultaneous acquisition of data from airborne magnetics and electromagnetic (EM) systems. In EM systems the transmitter generates sharp current pulses that produce strong electromagnetic fields; the currents thus induced in the earth in turn create magnetic fields, which are measured by the EM receiver.

Any magnetometers installed on the same platform will be affected by the primary field (when the transmitter is on), and, to a lesser degree, by the secondary fields generated by the induced currents for a short time period following the turn-off of the primary field.

In order to facilitate concurrent use with EM systems, the Front End in DAARC500 (Gen-2), AARC500 (Gen-2)[1], AARC510[1] and DAS500 systems now supports a 'gating signal' used to identify the time windows during which the EM interference is active, therefore affecting the measurements of the magnetometers. The Front End subsystem, which is sampling magnetometers at rates up to F_S=1280 Hz, will discard measurements during EM active periods, replacing them with estimates based on the most recent "valid" readings acquired.

The gating signal is one of the inputs on the Miscellaneous Digital I/O connector (J30):

Gating Signal =	'high':	Magnetometer measurements allowed (i.e., normal state)
=	'low':	Magnetometer measurements disallowed (i.e., EM active)

Note that the gating signal is internally pulled-up to +5V. Consequently, if nothing is connected to it the system will perceive a 'high' input (allowing normal measurements).

[1] AARC500 and AARC510 units with S/N < 13051083 require retrofitting of J30 connector on rear panel.

The timing of the gating signal should be synchronized to EM activity carefully. Two approaches, illustrated in Figure 1, are supported:

Method A – The gating signal is ‘low’ for the entire time window during which EM interference is active. This would include the on-time of the EM pulse, and the time during which secondary fields are relevant.

Method B – The gating signal is “tied up” to the EM pulse: it will be ‘low’ only while the EM pulse is active. To account for the effect of the secondary fields, a ‘hold-off’ count can be programmed into the system: the EM active state of the gating signal is effectively extended by a time window $T_{\text{hold-off}} = N_H / F_S$, where N_H is the hold-off count, and F_S the primary sampling rate of the system (e.g., 1280 Hz).

Clearly, in order for the gating mechanism to be effective the outputs from the magnetometer sensors themselves must be stable during EM non-active periods – any transient effects caused by the EM pulse must be fully settled.

Because of its unique characteristics, the gating function is implemented only when the transfer function selected is ‘Custom2’. With all other transfer functions in the system, magnetometer measurements always operate in the normal fashion.

[User’s Guide: Sections 4.3.2 and 2.3.12]

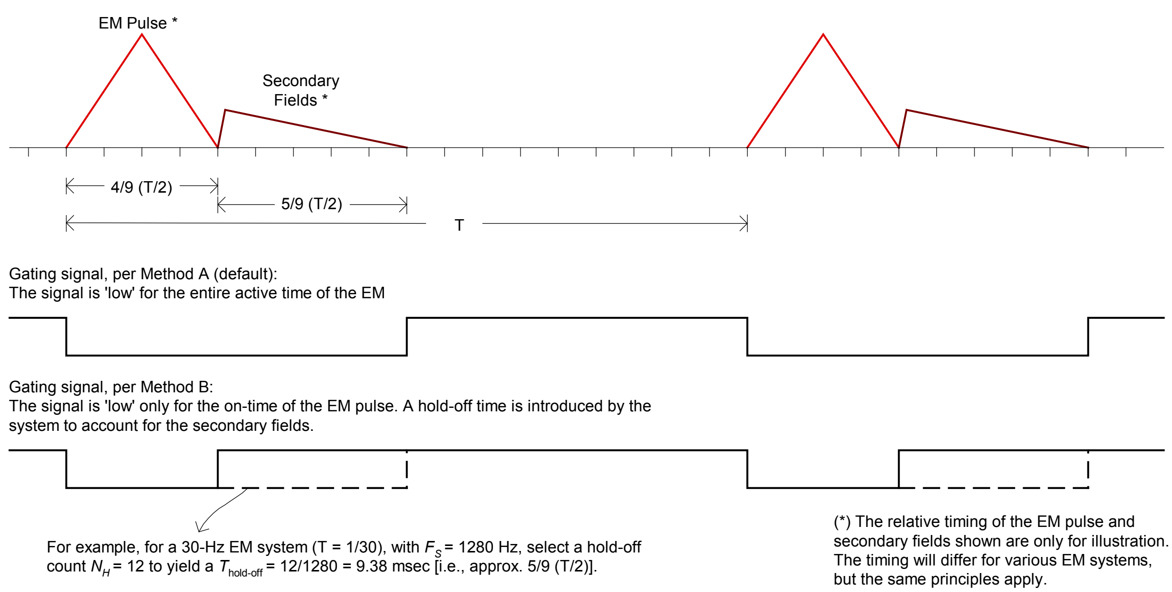

Figure 1

3. The firmware supports the DAS500 product. The DAS500 is a flexible and powerful data acquisition system with comprehensive support of magnetics (up to 8 total-field magnetometers). A vector magnetometer and interface are available as options (to allow post-flight compensation) – the Front End firmware will work with or without the optional vector magnetometer.
4. Enhancements to the error/warning reporting system, in the context of systems with more than four total-field magnetometers (up to eight).
5. Additions to the (internal) command set to provide more flexible quality control and troubleshooting tools.