NANOMOTION LTD.

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# Technical Bulletin: 4

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## SpiiPlus Over - Heating Protection for Nanomotion Motors Operating With AB5 Drivers

### Introduction

This technical bulletin focuses on applications that work in high duty cycle, which might reach the limits of the motors Envelop of Performance (EOP). In addition to applications that work in high duty cycle, over-heating can occur during system integration, when the system itself has not yet been conditioned and operation not yet stabilized. Nanomotion has developed an over - heating protection feed-forward procedure for such applications, which support the operation of the Nanomotion AB5 amplifier/driver (in configurations of up to 32 motor elements) in conjunction with ACS SPiiPlus controllers.

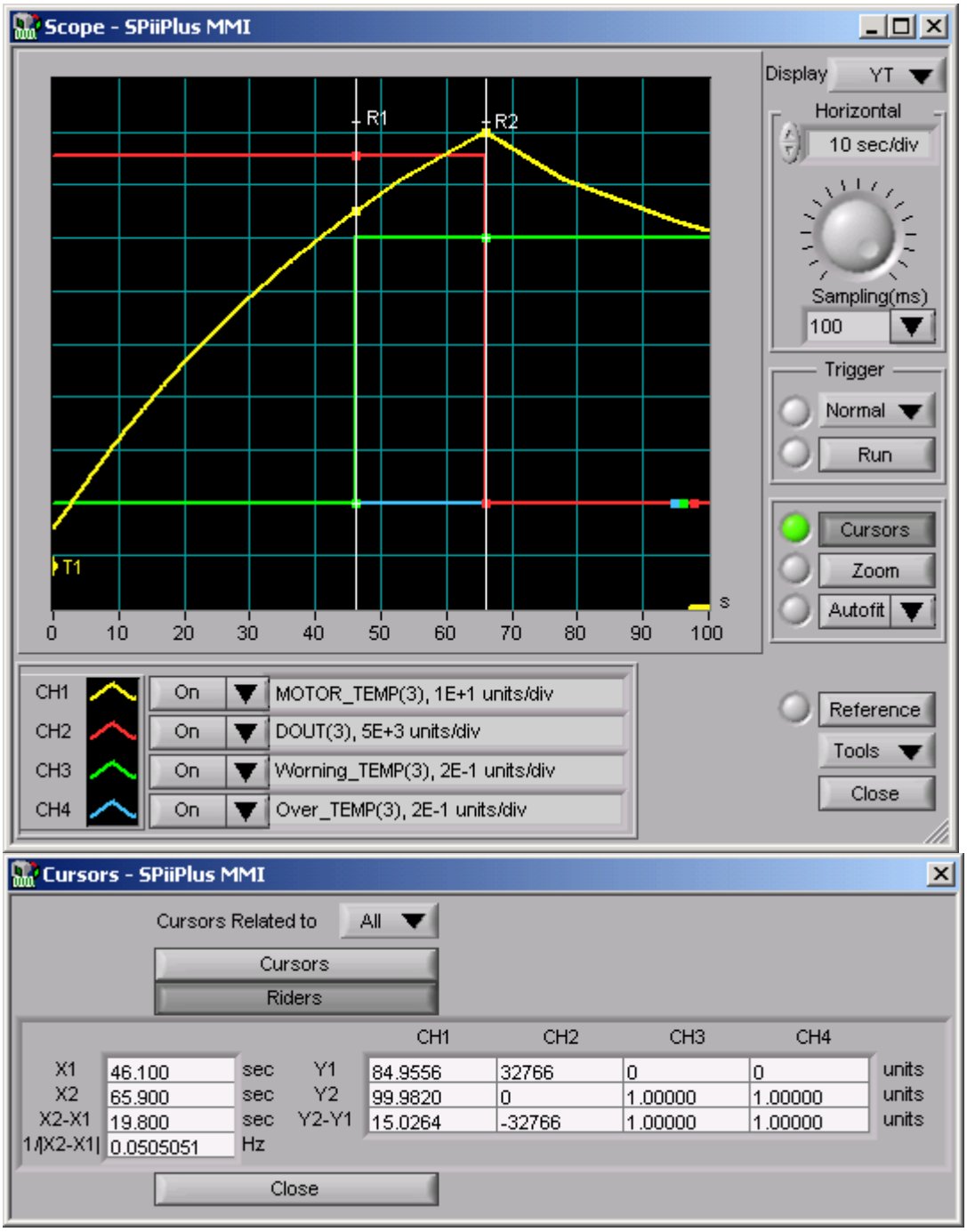
The AB5 amplifier/driver is unique in its mode of operation from the other Nanomotion drivers, as it allows a full linear response from very low commands. In order to do so, the AB5 sends a signal to the motor at all times, even at 0 command. As such, in certain applications, such as vacuum applications where heat dissipation is critical, and non-vacuum applications that operate at high duty cycle, this over-heating protection is particularly suited.

Please note that the over-heating protection program needs a separate buffer per axis. The user will set the axis parameter in the program.

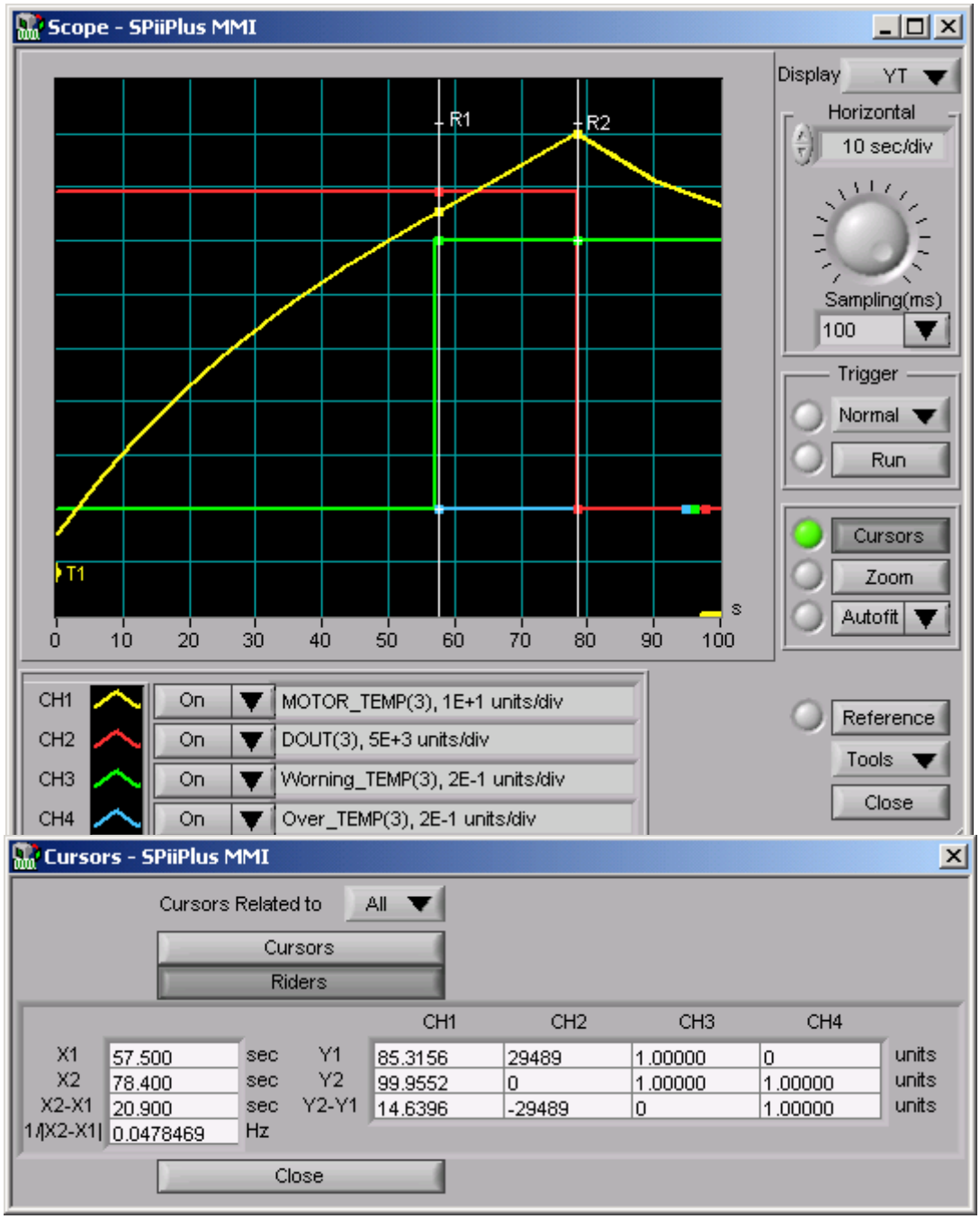
## Method of Operation

The following steps outline the method in which to implement the SPiiPlus over-heating protection feature for AB5 drivers:

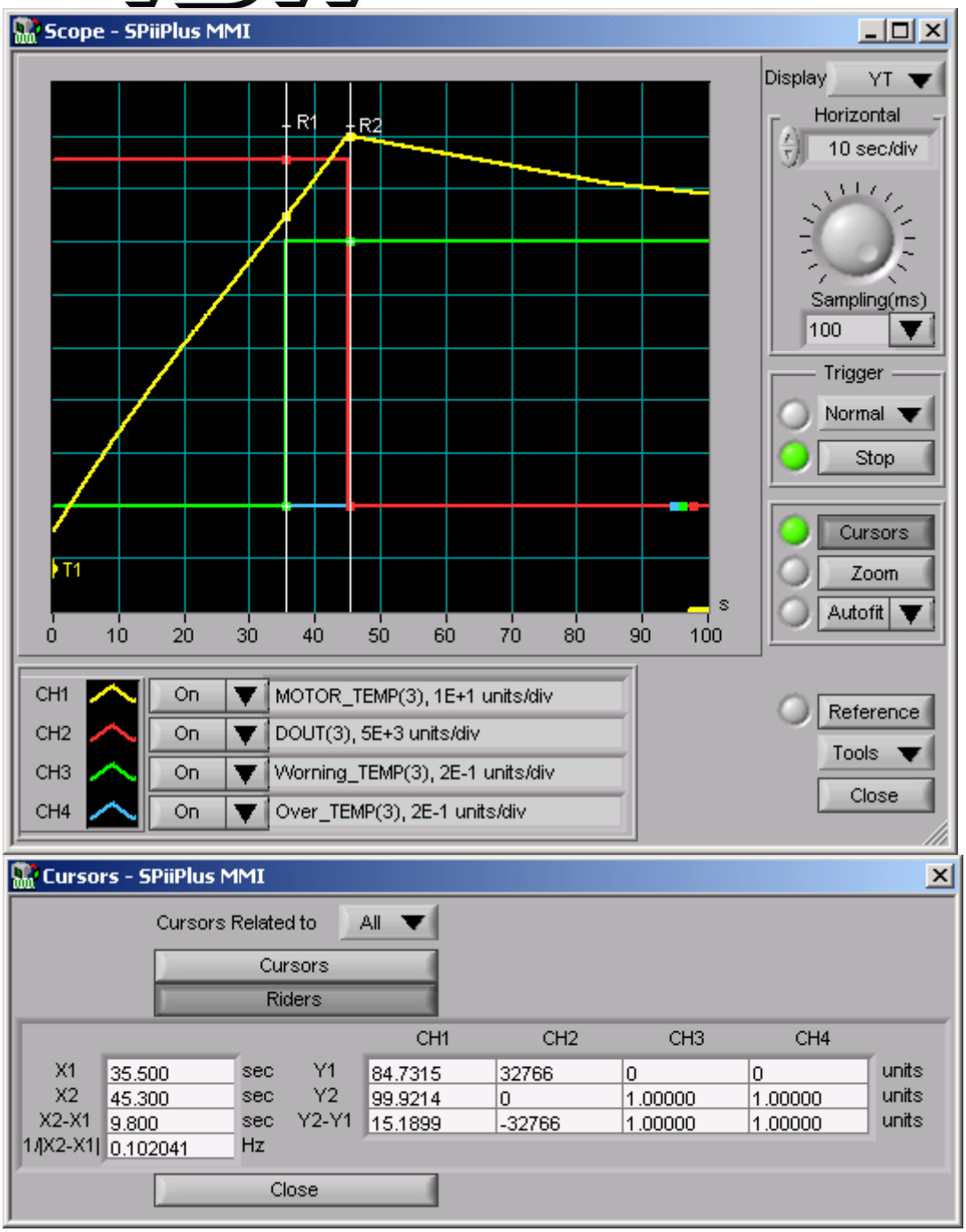
1. How to use the application program within the SpiiPlus program:
    - Open the SPiiPlus MMI window
    - Use the Application Loader and browse for application file **AB5_EOP_Protection**
    - The application contains two buffers, 5 and 6, and two arrays COMMAND_DT and COMMAND_DTV
    - Find two empty buffers and download the application.
    - Buffer 5 is set to the X- Axis for AB5 for all HR motor configurations (except HR32), for a default temperature of 25℃ ambient – free air-cooling (the temperature should be set to suit your applications specifications)
    - Buffer 6 is set to A- Axis for AB5 for HR32 for 40℃ ambient temperature – in vacuum chambers.
    - Open the buffers and set these parameters **axis, AMBIENT_TEMP**, **HR32_FACTOR** ,**Vacum_sw** to the right axis combinations.
    - If there are more than two axes in the system, copy buffer 5 or 6 to an empty buffer and set for the right combination.
    - Execute all the AB5 buffers. Each buffer will stay “green” all the time and will protect the motor. The SpiiPlus RMS protection is cancelled by the buffer.
    - For terminal reporting for one of the global parameters perform the terminal command “?global parameter” for example motor temperature in X axis
      ? MOTOR_TEMP(0)
    - Please see below scope record.




Open loop 10 Volts command free air cooling ambient temperature 25° C




HR motor open loop 9 Volts command free air cooling ambient temperature 25℃




HR32 motor open loop 10 Volts command vacuum chamber ambient temperature 25℃

The following are the new global parameters as configured by the SPiiPlus over-heating protection program:

- **MOTOR_TEMP(8)**- Array for all 8 axes indicate motor element temperature
- **Warning_TEMP(8)**- Array for all 8 axes, integer latch flag, if the motor temperature exceeds 85℃ latch 1
- **Over_TEMP(8)** - Array for all 8 axes, integer latch flag, if the motor temperature exceeds 100℃ **latch to 1 and disable the motor**
- **COMMAND_DT** – Temperature gradient array for free air operation that saved on flash
- **COMMAND_DTV** – Temperature gradient array for **vacuum** operation that saved on flash

The following are the new local parameters as configured by the SPiiPlus over-heating protection program:

- **HR32_FACTOR**- Real default set to 1, for HR32 set by user to 1.1
- **AMBIENT_TEMP** –Real default set to 25 can change by user to the real ambient temperature
- **axis** – Default set to 0 – X-Axis can be set by user to any axis
- **ROW** – Not for use: calculated by the program to find the row in the array
- **COLUMN** – Not for use: calculated by the program to find the column in the array
- **Vacum_sw**- Vacuum switch default 0- for free air operation **1- for vacuum operation**

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