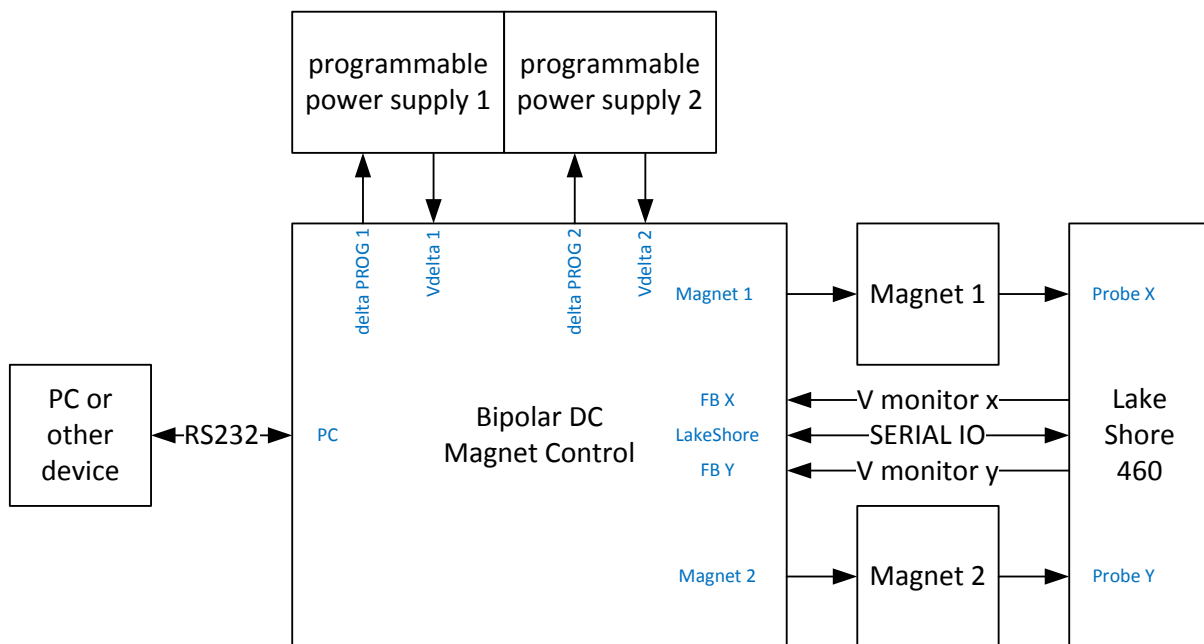# Bipolar DC Magnet Control User Manual

Connecting the controller

Controller operation

First power up the Lake Shore 460, then switch on the power supply and finally power up the Bipolar DC Magnet Control. At start up the controller will initialise the Lake Shore 460 and determine whether the type of probes used are HSE or HST.

The magnetic fields are controlled using a combined analogue and digital control loop. The analogue loop continuously corrects for offsets and speeds up the response of the magnet. However this loop is not so accurate. To reach high accuracy the measured magnetic fields are requested from the Lake Shore 460 by the digital control loop. The digital control loop corrects for any offset 8 times per second.

The order to switch of the devices is power supply , controller and then the Lake Shore 460. Make sure to stop control before switching off.

Local operation

The magnetic field and operation of the Bipolar DC Magnet Control can be set locally by hand using the keypad on the front of the controller. To do this make sure that the display shows "LOCAL" in the bottom right corner. Use the REMOTE switch on the front panel to switch between local and remote mode.

Push any button on the arrow keypad to enter select mode. This is shown on the display by a blinking cursor. Navigate to the digit that must be changed using the arrow keys and press OK to enter edit mode. In edit mode the selected digit is underlined. Pressing up or down changes the value of that setpoint by the amount of that digit. The first position on the left of the display is reserved for the sign of the setpoint.

Hold the up or down button to keep changing the setpoint. Press left or right to select another digit of that setpoint. When the editing is done press OK.

The right upper corner shows the control mode. This can be:

       controlling

       hold digital control

       stop

In edit mode these symbols show up on the right side of the display for selection.

During controlling the measured magnetic fields are shown on the display followed by a symbol.

       The measured value is within the specified tolerance from its setpoint

       The measured value is not within the specified tolerance from its setpoint

If an alarm occurs this is shown by an "!" on the display and control will be stopped. To reset the alarm use a paperclip to press the reset button between the display and the keypad or restart the controller using the power switch.

Other settings like control parameters and limits can only be changed in remote operation.

Remote operation

Use the remote switch on the front panel to set the Bipolar DC Magnet Control in remote mode. This disables the keypad and allows setpoints to be set via a RS232 connection.

RS232 settings:
9600 baud, no parity, 8 data bits and 1 stop bit.

Each command is terminated by a "*" and each reply ends with ";". Do not send anything to the controller before the last reply was received.

Commands that retain their value after reset are indicated with (flash)

RS232 commands :   9600 baud, no parity, 8 data, 1 stop
All commands end with ' * '.
Do not send a new command before having received a ' ; '

Control commands

CTRL*	start controlling	#;
HOLD*	hold digital control	#;
STOP*	stop controlling	#;
?CTR*	request operational status	CTRL; STOP; or HOLD;
#CTR*	request nr. of available controllers	2; or 4;
ALLF*	request field measurements in [mT]	channel x, channel y;

Controller setting commands

KP 123456*	set P gain of the control loop	#;
KI 123456*	set I gain of the control loop	#;
KD 123456*	set D gain of the control loop	#;
?KP*	request P gain	123456;
?KI*	request I gain	123456;
?KD*	request D gain	123456;
SPn -123456*	Set setpoint n [µT]	#;
?SPn*	request setpoint n [mT]	-123.456;
MAXB 123456*	set maximum magnetic field [µT]	#;

?MXB*	request setpoint limit [mT]	123.456;
TOL 9999*	set range [µT] from setpoint to display √	#;
?TOL*	request offset [µT] that is considered OK	1234;
?SPR*	setpoints reached? Binary coded/channel	3;
?ID*	controller number	1; or 2;
IDST 49*	set ASCII number 1 or 2 for ID	#;
RSTR*	restore control defaults	READY;
?ALM*	request detected alarms	binary coded per channel
ATH 1023*	set alarm threshold in 2^10 / 70V	#;
?ATH*	request high voltage alarm threshold	1023;

Operational commands

?MOD*	mode of operation	LOCAL; REMOTE;
RST*	reset controller unit	READY;
TEST*	test connection	DC MAGNET CONTROL ;
STEP*	toggle DACs between 1.55V and 1.60V	#;
ACTV 1*	control with #1 only 2 = 0b0010 = #2 only 3 = 0b0011 = #1 + #2 15 = 0b1111 = all active	#;
WrOnG*	non existing command, or communication error	!;