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TECHNICAL MANUAL

ABC VISA
INSTRUMENT DRIVER

KEPCO INC.
An ISO 9001 Company.

MODEL

ABC VISA
INSTRUMENT DRIVER

ORDER NO.	REV. NO

IMPORTANT NOTES:

1) This manual is valid for the following Model and associated serial numbers:

MODEL	SERIAL NO.	REV. NO.

2) A Change Page may be included at the end of the manual. All applicable changes and revision number changes are documented with reference to the equipment serial numbers. Before using this Instruction Manual, check your equipment serial number to identify your model. If in doubt, contact your nearest Kepco Representative, or the Kepco Documentation Office in New York, (718) 461-7000, requesting the correct revision for your particular model and serial number.

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ABC VISA INSTRUMENT DRIVER

The VISA instrument driver supplied with the ABC Power Supply is provided to simplify programming with a VISA compatible GPIB controller. The latest driver can be downloaded from the Kepco website (http://www.kepcopower.com/drivers.htm). Included on the driver are:

- source code (C) for all VISA functions (kp_ABC.c)
- a sample application of the VISA functions (written in C) which can be used to program one or more ABC power supplies using a virtual front panel observed on a computer monitor (ABC_appl.c).

Since the software drivers supplied by Kepco are VISA compliant, they require the installation of the proper VISA driver from your GPIB card supplier. The Kepco website (http://www.kepcopower.com/drivers.htm) provides links to various vendor sites for these drivers.

1. VISA INSTRUMENT DRIVER FUNCTIONS

Kepco's ABC VISA instrument driver provides programming support for Kepco's ABC Power Supply (VISA I/O). It contains functions for opening, configuring, taking measurements from, test, calibration and closing the instrument. To successfully use this module, the instrument must be connected to the GPIB and the GPIB address supplied to the initialize function must match the GPIB address of the instrument.

Table 1 lists the functions that are available.

TABLE 1. ABC VISA DRIVER FUNCTIONS

Purpose	Function Name	Description
INITIALIZE FUNCTION		
Initialize	KpAbc_init	Initializes the instrument and sets it to a default configuration.
APPLICATION FUNCTIONS — This class of functions contains high-level test and measurement routines. These functions call other instrument driver functions to configure, start, and get readings from the instrument.		
Set and Measure	KpAbc_ApplicSetMeas	Used to either set and read back, or just read back the output voltage, current and operating mode of the power supply
Get/Set Memory Value	KpAbc_GetSetListValue	This function can either get or set the values stored in any one of the 40 available memory locations. Six parameter values can be stored in any one of the 40 locations: voltage level, current level, overvoltage level, overcurrent level, duration of the setting (if used in a program) and next memory address (if used in a program). Depending on the slide selection position, and the value of get/set switch, one of these values is read or set. The values are checked against the maximum acceptable values for the corresponding power supply.
CONFIGURATION FUNCTIONS — This class of functions configures the instrument by setting system configuration parameters.		
Set Program Start Address	KpAbc_SetStartAddr	Sets the memory start address for the program chain. The program chain can also be executed in local mode. The start memory address range is from 1 to 40.
Get Program Start Address	KpAbc_GetStartAddr	Gets the memory start address for the program chain. The program chain can also be executed in local mode. The start memory address range is from 1 to 40.
Set Maximum Limit Value	KpAbc_SetMaxLimValue	Sets the temporary voltage limit or current limit of the power supply. The limit reduces the output range of the power supply. For example, the output voltage range of a 0 to 10V power supply can be limited to the range of 0 to 5.25V by setting the voltage limit to 5.25V.
Get Minimum or Maximum Value	KpAbc_GetMinMaxValue	Gets the minimum or the maximum output voltage, output current, overvoltage level, or overcurrent level of the power supply depending on the min_max switch and slide selection position.

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TABLE 1. ABC VISA DRIVER FUNCTIONS (CONTINUED)

Purpose	Function Name	Description
Set Trigger Voltage and Current	KpAbc_SetTrig_Volt_Curr	Sets the trigger voltage and trigger current at the same time
Set Trigger Value	KpAbc_SetTrigValue	Sets the trigger voltage or trigger current level, depending on the switch position.
Get Trigger Value	KpAbc_GetTrigValue	Gets the trigger voltage or the trigger current level, depending on the switch position.
Set Overvoltage and Overcurrent	KpAbc_Set_OVvolt_OVcurr	Sets both the overvoltage and overcurrent values.
Set Protection Delay	KpAbc_setProtDelay	Sets the protection delay: the delay between the moment the output voltage and current are changed and the moment the overvoltage and overcurrent protections are enabled.
Get Protection Delay	KpAbc_getProtDelay	Displays the protection delay count for the power supply. A count of 30 represent ~ 1 second. The protection delay is the delay between the moment the output voltage and current are changed and the moment the overvoltage and overcurrent protections are enabled.
ACTION/STATUS FUNCTIONS — This class of functions executes commands and queries. It also provides functions which allow the user to determine the current status of the instrument.		
Set Voltage and Current	KpAbc_Set_Volt_Curr	Sets the output voltage and current at the same time.
Set Value	KpAbc_SetValue	Sets the output voltage, the output current, the overvoltage level, or the overcurrent level of the power supply, depending on the slide selection position. The values are checked against the maximum acceptable values for the corresponding power supply.
Get Value	KpAbc_GetValue	Gets the output voltage, the output current, the overvoltage level, or the overcurrent level of the power supply depending on slide selection position.
Trigger	KpAbc_Trig	Triggers the instrument once. The output will go to the trigger voltage and current values.
Measure Output Value	KpAbc_MeasValue	Measures the value of output voltage or current depending on the switch position.
Get Source Mode	KpAbc_GetSourceMode	Gets the operating mode of the power supply.
Output On/Off	KpAbc_OutputOnOff	Sets the output on or off.
Get Output Status	KpAbc_getOutputState	Returns the output status (on or off).
Get Protection Status	KpAbc_getProtectionStatus	Gets the status of overvoltage or overcurrent protection (triggered or not triggered).
Clear Protection	KpAbc_clearProtection	Clears the overvoltage or overcurrent protection.
Abort Measurement	KpAbc_abortMeas	Sends the abort command.
Beep	KpAbc_beep	The selected ABC power supply will emit a beep.
DATA FUNCTIONS — This class of functions transfers data to or from the instrument.		
Set Memory Index	KpAbc_SetIndex	Sets the index pointer to one of the 40 available memory locations The subsequent memory value changes will affect the memory location pointed to by the index pointer.
Get Memory Index	KpAbc_GetIndex	Gets the value of the index pointer.
Set Memory Value	KpAbc_SetListValue	Depending on the slide selection position, this function sets the value of the specified parameter (voltage level, current level, overvoltage level, overcurrent level, time value, next memory address value) for the memory location pointed to by the index pointer.
Get Memory Value	KpAbc_GetListValue	Depending on the slide selection position, this function gets the value of the specified parameter (voltage level, current level, overvoltage level, overcurrent level, time value, next memory address value) for the memory location pointed to by the index pointer.

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TABLE 1. ABC VISA DRIVER FUNCTIONS (CONTINUED)

Purpose	Function Name	Description
Save/Recall Settings	KpAbc_SaveRecSet	Saves the current settings to the selected memory location or restores previously stored settings from a memory location. The memory location range is from 1 to 40.
UTILITY FUNCTIONS — This class of functions provides lower level functions to communicate with the instrument and to change instrument parameters.		
Identify Power Supply	KpAbc_identify	Returns the full message returned by the power supply to the *IDN? query. This message contains four fields: manufacturer, power supply type, serial number and firmware version.
Revision Query	KpAbc_RevisionQuery	Returns the revision numbers of the instrument driver and instrument firmware version from the *idn? query. This instrument driver's Revision Number is "Rev 1.0, 9/95, CVI 3.1" and the ABC firmware version is Firmware Version "1.0". This data is necessary when requesting technical support.
Model Query	KpAbc_ModelQuery	Return the model number of the ABC power supply.
Serial Number Query	KpAbc_SerialnQuery	Returns the serial number of the ABC power supply. The serial number is extracted from the answer to the *idn? query.
Query SCPI Version	KpAbc_GetScpiVersion	Returns the power supply answer to the Query SCPI Version command. Checks the Standard Commands for Programmable Instruments (SCPI) language version.
Set/Reset Keypad Lock	KpAbc_setResetKeybLock	Locks or unlocks keypad operation. Used to prevent changing the settings of the power supply from the local keypad.
Keypad Lock Status	KpAbc_keybLockStat	Return the status of the local keypad access: 0 if local access enabled; 1 if local access is disabled.
Display Text	KpAbc_display	Configures the front panel display of the instrument. In normal mode the values measured at the output of the power supply are displayed. In text mode a user defined string can be displayed on the second row of the display.
Get Display Text	KpAbc_getDisplay	Gets the string which is displayed on the second line of the display.
Get Display Contrast	KpAbc_getContrast	Gets the contrast value of the front panel display of the instrument (between 0.1 and 0.9).
Set Display Contrast	KpAbc_setContrast	Configures the contrast of front panel display of the instrument (value between 0.1 and 0.9).
Write To Instrument	KpAbc_writeInstrData	This function writes commands and queries to the instrument to modify parameters and query device settings.
Read Instrument Data	KpAbc_readInstrData	This function reads data from the instrument's output buffer and returns it to the specified variable in memory. Because the instrument may return both numeric and text data in response to queries, this function returns the data in string format. NOTE: If valid data is not available at the instrument's output buffer when this function is called, the instrument will hang up and the function will not return until it times out. If the time-out is disabled,` this function will hang indefinitely and it may be necessary to reboot the computer to break out.
Reset	KpAbc_psReset	Resets the instrument to a known state and sends initialization commands to the instrument.
Self-Test	KpAbc_selfTest	Runs the instrument's self test routine and returns the test result(s).
Error-Query	KpAbc_errorQuery	Reads an error code from the instrument's error queue.
Error Message	KpAbc_errorMessage	Takes the Status Code returned by the instrument driver functions, interprets it and returns it as a user readable string.
Calibration Status On/Off	KpAbc_CalStatus	Used to enter or exit the calibration state. To enter the calibration state a 4 digits password is required. When the instrument is shipped from the factory the calibration password is the 4 digit model number. The password protects the instrument against unauthorized calibrations.

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TABLE 1. ABC VISA DRIVER FUNCTIONS (CONTINUED)

Purpose	Function Name	Description
Calibration Mode	KpAbc_CalMode	Allows the user to select the calibration mode (either voltage or current calibration) and also allows selection of 0 (min) or full scale (max) calibration.
Calibration DigPot	KpAbc_CalDigPot	Allows a more accurate full scale calibration in both voltage or current mode. Moving the digital potentiometer allows the user to approach the nominal full scale value of the corresponding power supply. This is a coarse adjustment for the full scale value which must be followed by a fine adjustment done with the Calibration Output function.
Calibration Output	KpAbc_CalOutput	Allows the user to perform the power supply calibration in both voltage or current mode. By moving the digital to analog converter the number of LSB's specified in the repeat count, the user can approach the 0 or full scale value of the corresponding power supply. This is a fine adjustment for the 0 or full scale value. The user can specify a repeat count between 1 and 9 in order to avoid having to repeat sending the command
Calibration Zero	KpAbc_CalZero	Used to zero the output of the power supply before switching from voltage calibration to current calibration (to allow a calibration resistor to be connected between the power supply output terminals.
Calibration Save	KpAbc_CalSave	Stores the calibration results in the nonvolatile calibration memory of the instrument.
Security Code	KpAbc_CalCode	Allows the user to change the password to prevent accidental or unauthorized calibrations of the instrument. The password is stored in nonvolatile memory, and does not change when power has been off or after a reset. To change the password, the instrument must already be in calibration status, ensuring that the user knows the current password. If the password is lost, call the factory for support.
Close	KpAbc_close	This function takes the instrument off-line.

2. DEMONSTRATION PROGRAM USING THE VISA DRIVER

The demonstration program is intended to illustrate the use of the VISA functions included with the ABC power supply. The program can be used as is, or used as a starting point for a custom user-designed program. The source file (kp_appl.c) is included on the VISA driver diskette. The demonstration program is installed under Windows by running SETUP.EXE. The program can be used to program and view the virtual front panels of up to 10 ABC Power Supplies. After the program is installed, double click on kepco-abc.exe to run the program.

After the program is installed, double click on ABCCTRL.exe to run the program.When the GPIB Setup window opens, enter the GPIB address of the ABC power supply to connect to the VISA interface. If the power supply type is correct, the Continue button will open the Main Panel (Figure 2).

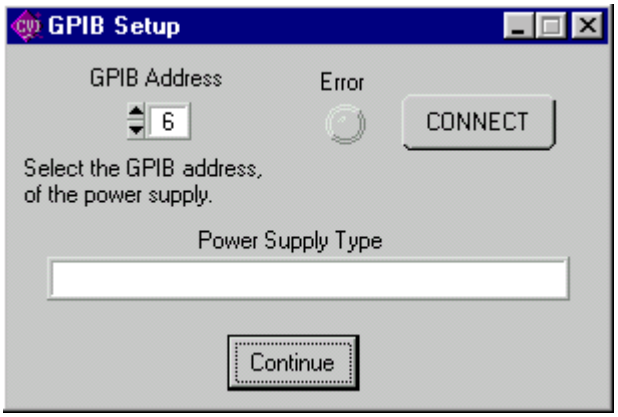


FIGURE 1. GPIB SETUP WINDOW

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. Once you are connected, you will see the Main Panel (Figure 2).

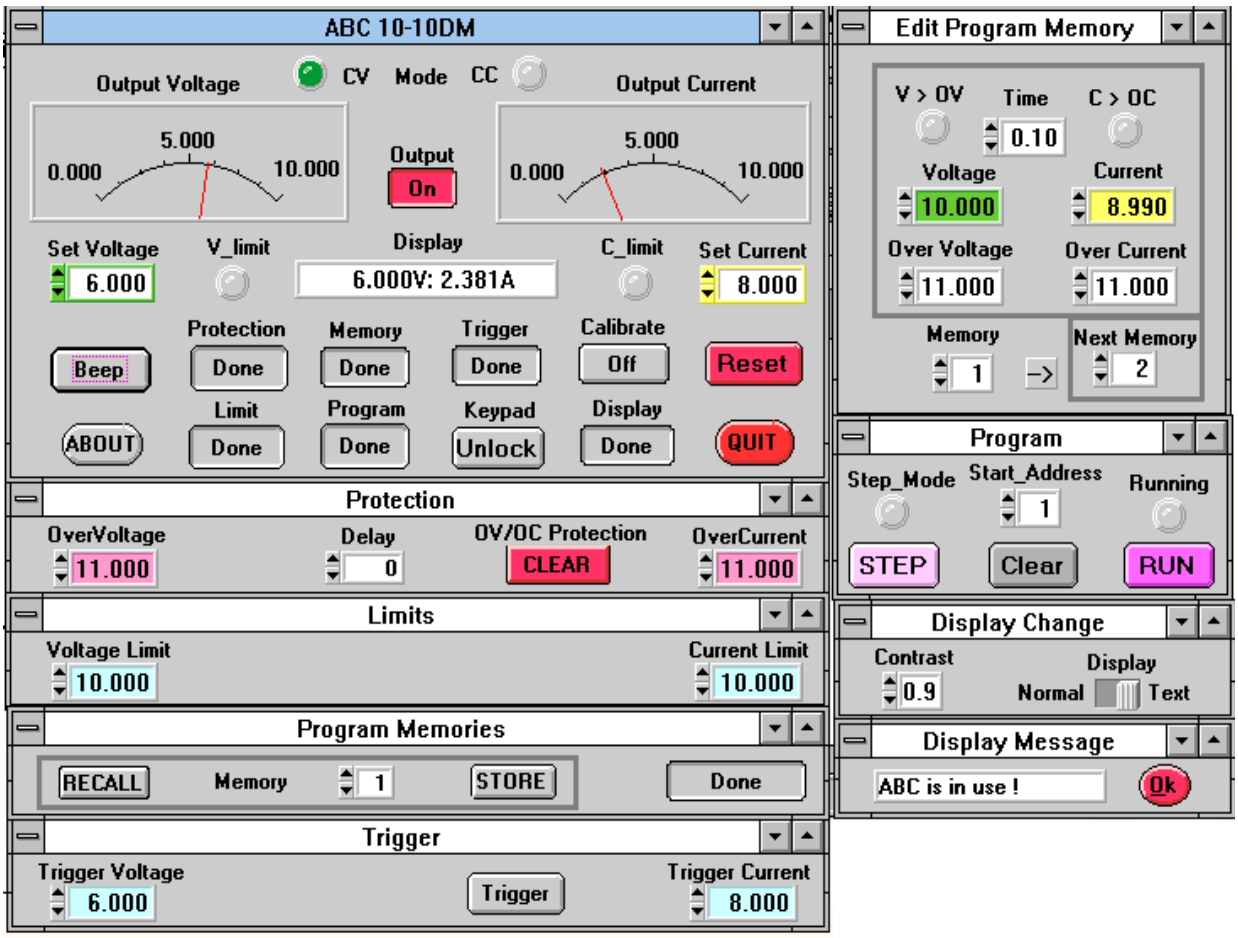


FIGURE 2. ABC VISA APPLICATION, VIRTUAL PANEL PLUS SPECIAL FUNCTION WINDOWS

The virtual front panel can show all power supply parameters simultaneously, without the having to execute local controls and read the corresponding display. The virtual panel is a real-time display of output values and programmed parameters. All local functions are also available from the virtual panel. The virtual panel is shown at the upper left of Figure 2; additional windows for Protections, Limits, Program Memories (below the panel), Edit Program Memory, Program, Display Change, and Display message (To the right of the panel) are also illustrated.

At the top of the panel, the Mode indicators light to indicate whether the power supply is operating in either **CV** (constant voltage) or **CC** (constant current) mode. At the top left and right are analog meters that read actual output voltage and current; a **Display** window at the center provides a more precise digital readout of actual output voltage and current. Above the display window, between the two analog meters, is the **Output** button which either applies the programmed settings to the output terminals (ON) or keeps the output voltage and current at zero (OFF). Indicators on either side of the digital display window, **V limit** and **C limit**, light (red) if the programmed voltage or current limit is exceeded. The **Set Voltage** and **Set Current** windows are adjacent to the limit indicators. Displayed settings can be changed either by clicking on the arrows to the left of the display window, or by using the mouse to highlight the setting, then typing in the new value.

Additional features can be accessed by twelve buttons arranged in two rows of six at the bottom of the panel. The **Beep** button causes the selected power supply to beep. The **Protection** button opens the **Protection** window that shows the overvoltage, overcurrent and protection delay settings, the **OV/OC Protec-**

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tion CLEAR button resets the overvoltage and overcurrent protection if it has tripped (voltage and current are reset to the programmed values in effect when protection tripped). The **Memory** button opens the **Program Memories** window that allows the active values for output current and voltage, and programmed settings for overvoltage and overcurrent protection to be stored in one of the 40 available memory locations, or be recalled from a previously stored location. The **Trigger** button opens the Trigger window which allows trigger voltage and current values to be set; the **Trigger** button within the Trigger window causes the power supply output to be programmed to the settings of trigger voltage and current. The **Calibrate** button is used to recalibrate the unit (see Section 4 of the Technical Manual). The **Reset** button resets the unit to the power on defaults: output voltage and current set to zero, overvoltage and overcurrent set to approximately 10% above rated maximum.

The **ABOUT** button displays the model, serial number and firmware version number. The **Limit** button opens the **Limits** window that reveals the Voltage and Current Limit settings. The **Program** button opens two windows used to control local programming. The **Edit Program Memory** window is used to view or change any of the six stored parameters for the memory location selected by the Memory window. The **V > OV** and **C > OC** indicators light (red) if the **Edit Program** values for voltage or current exceed the **Edit Program** values for Overvoltage or Overcurrent. The **Program** Window is used to execute the local program established by the **Edit Program** Window. The **Step** button executes one memory location at a time, starting at the **Start Address**; the **Step Mode** indicator lights after the first step is executed. As each step is executed, the corresponding values for each parameter are displayed in the **Edit Program Memory** window. The **Run** button causes the program to be executed starting at the location in the **Start Address** display window; the **Running** indicator lights (green) while the program is running. The **Clear** button stops a program that is running.

The **Keypad** button either enables (UNLOCK) or disables (LOCK) the local keypad of the selected ABC power supply. The **Display** button opens the **Display Change** window which allows adjustment of the local LCD contrast, and selection of Normal/Text mode for the LCD. In Normal mode, the bottom line of the local LCD displays output voltage and current. In Text mode, the text typed in the **Display Message** window is displayed on the bottom line of the LCD. The **QUIT** button is used to exit the sample VISA application.

WARNING:

Once the program is started, actual values of output current and voltage are displayed. If you exit the program while the power supply is still on, the programmed settings in effect at that time are maintained after exiting the program.

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3. EXAMPLES

The following examples show the functions needed to set voltage to 15V, current to 2 amp and output ON.

Example 1:

```
ViByte ps_type;
ViSession ABC_Session;

Kpabc_init ("GPIB0::6", 1, &ps_type, &ABC_Session);   //init ps
Kpabc_Set_Volt_Curr (ABC_Session, 15, 2);             //voltage and current
Kpabc_OutputOnOff ( ABC_Session, 1);                  //output on
```

Example 2:

```
ViByte ps_type;
ViSession ABC_Session;

Kpabc_init ("GPIB0::6", 1, &ps_type, &ABC_Session);   //init ps
Kpabc_SetValue (ABC_Session, 0, 15);                  //voltage
Kpabc_SetValue (ABC_Session, 1, 2);                   //current
Kpabc_OutputOnOff ( ABC_Session, 1);                  //output on
```


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