Won ATech

FC] Flow Cell Controller

Customize Your Own Controller Now!



- Gas or liquid flow speed control
- Flow on/off control
- Temperature control
- External humidifier control (gas flowing on/off, dry/wet gas selection etc.)
- Rotator control
- External potentiostat/galvanostat or electronic load control
- Customized design avaliable

Flow Cell Controller for control and monitoring 3rd party devices

The FC1 Flow Cell Cntroller is a basic controller from SMART2 fuel cell test system controller family and it is specially designed for process control purposes. It is suitable for operating parameters for other devices such as MFC, heating device, solution supply pump, rotator, etc. For example, user can build his/her own system for monitoring flow cell performance by connecting relevant components and equipments.

Main Board			
Digital Input(DI) • for emergency button • for level sensing Digital Output(DO) • for SSR control • for valve control	Analog Input(AI) • for temperature measurement • for flow rate measurement • 2x universal analog input port (10V DC) Analog Output(AO) • for flow rate control • 2x universal analog output port		
	(10V DC)		

• Additional Modules

- MFC Module, GM1
- Temperature Module, TM1
- Humidifier Module, HM1

It contains two general purpose Al(analog input)/AO(analog output) in the range of 0 ~ 10V, which are located on the front panel and other signal in/out ports on the back panel. And it communicates with a computer by the way of a Local Area Network(LAN).

The FC1 supports various safety features including watchdog, emergency button, limit values, etc. for both personal safety and instrument protection. A GUI(graphical user interface) provides an easy-to-use powerful interface for novice and adavanced users.

Features

- Compact design
- Allows user to easily customize a truly unique controller for a flow cell system.
- A flow cell controller with 2ea analog inputs and 2ea analog outputs
- A software with powerful graphical user interface.
- The various safety functions are provided to protect the cell and system from being damaged.
- LAN communication

• WFTS[™] Software

The WFTS[™] software consists of server program to communicate with system, main program to control & data acquisition and data managing program for analysis. Automatic control and data acquisition is conducted through pre-programmed single or group schedules in the software.



- Quick and easy test configuration
- Real-time graphic data output
- User friendly graphical user interface
- Continuous data logging
- Background server program
- Independent data managing software
- Button click & play mode
- VOI (Value of Interest) displaying selection
- Colorful display of each module status
- Setting/reading value display

• Flow Cell Controller Usage Examples

Fuel Cell Test Application

- System Configuration
- MFC(Mass Flow Controller)
- Methanol pump
- Humidifier
- Electronic load
- Back pressure regulator
- Temperature measurement
- Pressure measurement etc.

Redox Flow Batteries Application

System Configuration

- Liquid flow control
- Temperature control
- Potentiostat/Galvanostat

RDE(Rotating Disk Electrode) Test Application

Rotating System(RPM Control)

Chlor-Alkali Process

- Pump control
- Temperature control etc.

Flow Cell for Electrochemical Synthesis

- Pump control
- Temperature control etc.

Solid State Battery Application

Data Manager

Independent data analysis program for WFTS software.

♪ DataManager - graph - [C:₩wfts₩NewFormat₩cstep_CH1.wrd]	
DataProcess(<u>D</u>) Graph(<u>G</u>) Report(<u>R</u>) Window(<u>W</u>) <u>H</u> elp	
Metric Construction Section 2 (Section 2) Section 2 (S	1 🖉 🖉
graph - [C:\#wfts\NewFormat\Cstep_CH1.wrd]	
Ready	

• Multi Y Axis Graph

Selecting item	and files !!				
Select file C:\wwft	s₩NewFormat₩cstep_CH1.wrd				_
	[Test Information]		[]	[tem Selecting] ——	
Channel : 1	Test Duration: 2005/ 04/ 20 11:30	~ 2005/ 04/ 20 13	:06 X axis	RunningTime	-
Schdule file : C:\	wfts₩Sch₩psm₩Cstep.SC1		Y1 axis	Current	-
Sch file count 1	CellCount : 0	Area 5.0	00 V2 axis	Voltage	
Memo:			──	Voltage Volt[AN]	
			✓ Y4 axis	Volt[CA] Volt[SUB]	
Graph information]				Power	
Max. step count 3	Max. cycle count 9 Min	n. plot count 40	Y axis count 4	Current Density	
Total plot count(Mi	n. plot count * Y axis count 160	*** N	Max. plot count = 10	H2 Metanol	

User selectable time base 4 Y axis graph.

Any of measured parameters can be selected for each axis.



=:

• Graph Parameter Selection

- View mode selection : result/schedule/cycle/step
- Result number selection
- Schedule number selection
- Cycle number selection
- Step number selection



4th cycle, 3rd step selection

Axis & plot configuration



🛃 Co	nfiguration	Plots							
Plot	1 Plot-2	Plot-3 P	lot-4 Pk	ot-5 Plot	-6 Plot-	7 Plot-8	Plot-9	Plot-10	[Properties]
Plot-	11 Plot-12	Plot-13	Plot-14	Plot-15	Plot-16	Plot-17	Plot-18	Plot-19	Color Change
Plot-	20 Plot-21	Plot-22	Plot-23	Plot-24	Plot-25	Plot-26	Plot-27	Plot-28	
Plot-	29 Plot-30	Plot-31	Plot-32	Plot-33	Plot-34	Plot-35	Plot-36	Plot-37	
Plot-	38 Plot-39	Plot-40	Plot-41	Plot-42	Plot-43	Plot-44	Plot-45	Plot-46	Line width 1
Plot-	47 Plot-48	Plot-49	Plot-50	Plot-51	Plot-52	Plot-53	Plot-54	Plot-55	Point style Empty Square -
Plot-	56 Plot-57	Plot-58	Plot-59	Plot-60	Plot-61	Plot-62	Plot-63	Plot-64	,
Plot-	65 Plot-66	Plot-67	Plot-68	Plot-69	Plot-70	Plot-71	Plot-72	Plot-73	Load default value
Plot-	74 Plot-75	Plot-76	Plot-77	Plot-78	Plot-79	Plot-80	Plot-81	Plot-82	
Plot-	83 Plot-84	Plot-85	Plot-86	Plot-87	Plot-88	Plot-89	Plot-90	Plot-91	Apply
Plot-	92 Plot-93	Plot-94	Plot-95	Plot-96	Plot-97	Plot-98	Plot-99	Plot-100	Close

• General Specifications

Analog to Digital Converter(ADC)				
Resolution	16 bit			
Input voltage range	10V			
Digital to Analog Converter(DAC)				
Resolution	12 bit			
Output voltage range	10V			
Data Sampling				
Max. sampling interval	1 sec			
Interface				
Communication	TCP/IP (LAN) communication			

• Front Panel

Analog In(AI) Port, 2ea	
Connection	2 speaker terminal blocks
Input voltage range	0 ~ 10V
Input impedance	10 GOhms
Analog Out(AO) Port, 2ea	
Connection	2 speaker terminal blocks
Output voltage range	0 ~ 10V

Front View



• Rear Panel

MFC Port, 3ea	
Connection	D-sub 9 pin(female)
Flow control by AO	0 ~ 5V analog signal out
Flow monitoring by Al	0 ~ 5V analog signal in
MFC control power	+15V, -15V
Temperature Control Port	
Connection	D-sub 9 pin(female)
Temperature control by DO	signal relay & SSR, temp. module required
Temperature control	PID control
Sensing Port	
Connection	D-sub 37 pin(female)
Analog input	11ea
Analog input range	0 ~ 10V
Digital input	2ea
Default setup, Al	
For temperature sensing, 7ea	amplifier for thermocouple signal (temp. option) required
For pressure sensing, 4ea	pressure sensor(4~20mA output) required
Default setup, DI	
For level sensing	humidifier required for water level monitoring
Valve Control Port, 12ea	
Connection	D-sub 25 pin(female)
Valve control by DO	solenoid valve required
Control voltage	AC220V(default), DC 12V or 24V(option)

Rear View



System configuration can be customized upon request.

• MFC Module GM1, Option

Connection	D-sub 9p(female), 3 ports
Component	MFC, valves, tubings
Max. number of MFCs	Зеа
Max. flow rate	within range of 100 ~ 5000 SCCM user selectable
Control range	2% to 100% of full scale
Accuracy	± 1% full scale
Gas supply pressure requirement	3 bar(43.51psi)
Tubing material	SUS 316
Fitting	DK-LOK, 1/4"

• Temperature Module TM1, Option

Temperature Control & Monitoring			
No. of ports	7ea		
Temperature control	by SSR (PID control by FC1 controller)		
Temperature sensing			
Sensor	K-type thermocouple		
Signal amplication	0 ~ 10V output(10mV/ $^\circ\!\mathbb{C}$)		
Temperature range	0 ~ 1000 ℃		
Accuracy	±1℃		
Temp Monitoring Only			
No. of ports	7ea		
Temperature sensing			
Sensor	K-type thermocouple		
Signal amplication	0 ~ 10V output(10mV/ $^\circ\!\mathbb{C}$)		
Temperature range	0 ~ 1000 ℃		
Accuracy	±1℃		

• Humidifier Module HM1, Option

Temperature Module TM1 is included.			
Туре	membrane type (Nafion tube used)		
Bottle size	2x 1L(anode & cathode)		
Base material	stainless steel pipes, KS D 3576		
Top material	SUS 304		
Sealing	silicon gasket		
Insulation material	urethane foam		
Temperature control by DO	signal relay & SSR, temp. option required		
Temperature control	PID control		
Heater	band heater, 500Watt		
Tubing material	SUS 316		
Fitting	DK-LOK, 1/4"		
Water supply	automatic control with a level sensor		
Temperature control	by SSR(PID Control by FC1 controller)		
Temperature sensing			
Sensor	K-type thermocouple		
Signal amplication	0~10V output(10mV/°C)		
Temperature range	0~1000°C		
Accuracy	±1 °C		
Line heating available			



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