



E73-02, -05 PROGRAMMABLE/SELECTABLE SPEED INFUSION PUMPS



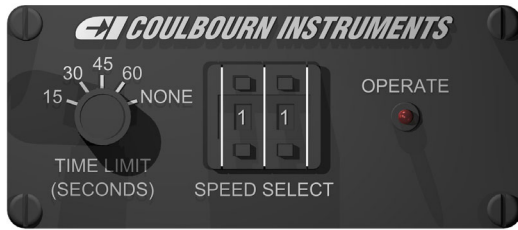


Figure 1: Front Panel Illustration

The ***E73-02 and E73-05 Programmable/Selectable Infusion Pumps*** are designed to administer a fluid/drug at a precise reproducible flow rate through either manual selection or program control using our state notation program **Graphic State** or an Analog-to-Digital Converter. These pumps are preferred when various flow rates are required or flow rates need to change during the course of an experimental session. Typical applications include drug testing, flushing catheters, electrolyte therapy, sucrose gradients, and other applications when precise control over the delivery of the vehicle is required.

The rocker switch on the top of the unit provides an enable/disable function. When placed in the enable position, the pump is placed in a ready mode and will operate when a 5 to 30 Volt DC signal is applied to the REMOTE input (*Figure 2*).

The Time Limit control on the front panel (*Figure 1*) allows the user to limit the amount of time that the pump can be activated each time a remote signal is applied to activate the pump. The available time limit settings (in seconds) are 15, 30, 45, 60 & none. The time limit function prevents fatal delivery of



Figure 2: Rear Panel Illustration

fluid/drug under fault or uncontrollable conditions.

The push-wheel switches (*Figure 1*) allow the user to select the speed at which the motor and lead screw will turn. The speed is selectable from 0.02 RPM to 1.98 RPM in the E73-02 and from 0.05 RPM to 4.95 RPM in the E73-05. The OPERATE indicator (*Figure 1*) will light when the remote operate control is activated.

The two .080" jacks on the rear panel (*Figure 2*) provide a remote input for external control of delivery. These inputs operate from +5V to 30Volts DC. The ultra-miniature phone jack labeled "PROG. INPUT" (*Figure 2*), provides a programmable input for controlling the velocity of the motor and ultimately the flow rate. The velocity can be varied from 0.02RPM to 1.98 RPM in the E73-02 and from 0.05 to 4.95 in the E73-05 with a 0V to 2.5V DC input.

The 4-pin DIN connector on the Rear Panel (*Figure 2*) is the power input. The Tabletop Power Supply supplied with the pump is attached to this connector.

The syringe holder has been designed to accommodate various size syringes. The slide mechanism can be adjusted in and

out by loosening the thumbscrew, placing the syringe in the holder, placing the thumbscrew to lock the syringe into place.

The plunger carriage has been designed with a knob and spring mechanism for easily re-locating the carriage to any position. Simply lift on the cap of the plunger adjustment, slide it up against the end of the syringe, and then release the cap. This makes initial setup of the pump and syringe simple.

An adjustable limit switch is also integral to this unit. A screw on the power cord side of the unit can be turned to adjust the trip point for the switch. The limit switch will disable power to the motor when the extent of travel has been reached.

A knob is provided on the side of the unit for manually advancing the plunger carriage in fine, incremental steps. This can also be used at initial setup to move the plunger carriage up flush with the syringe plunger.

FLOW RATE

The rate of flow is dependent not only on the velocity of the pump but also on the size of the syringe. For example the flow rate running at a velocity of 1.00 RPM while using a 2 cc syringe will be less than running at the same velocity with 10 cc syringe. Furthermore, it is the cross sectional size of the syringe that affects the rate of flow so the flow rate will also vary when using the same size syringe (e.g., 2cc) from different manufacturers.

The Flow Rate is determined by multiplying the velocity in RPM by 0.19538 by the cross sectional area of the syringe. The Flow Rate in milliliters per minute is equal to:

$$\text{RPM} \times 0.19538 \times C$$

where RPM is the velocity of the pump in revolutions per minute and C equals the cross sectional area of the syringe in square centimeters. (See Appendix A for the Cross Sectional Area of some common syringes).

SPECIFICATIONS

Selectable Speeds: 0.02 RPM (01 set on Speed Select) to 1.98 RPM (99 set on Speed Select) in 0.02 RPM increments

Linear Speed: 0.015 in/min to 0.1523 in/min

Power: 110-240 ~ 1A, 50/60Hz

Time Limit (seconds): 15, 30, 45, 60 & None (no time limit control set)

Programmable Input: 0 to 2.5VDC

Remote Input: +5-30 Volts DC

Dimensions: 8.75 inches x 3.0 inches x 3.0 inches
(22.23 cm x 7.62 cm x 7.62 cm)

Weight: 2.65 lbs (1.20 kg)

APPENDIX A

CROSS SECTIONAL AREAS OF COMMON SYRINGES

CROSS SECTIONAL AREA (cm sq)	SYRINGE SIZE (unless otherwise indicated)						
	1 cc	2 cc	5 cc	10 cc	20 cc	30 cc	50 cc
Becton, Dickinson & Co. Multifit Syringes	0.176	0.626	1.084	1.692	3.017	4.047	6.173
Becton, Dickinson & Co. Plastipak Syringes	0.173	0.578 (2.5 cc)	1.129	1.635	2.85	3.662	5.556
Burron Medical Products	0.184	0.712 (3 cc)	1.197	1.840	3.247	4.831	7.159 (60 cc)
Pharmaseal Laboratories Stylex Syringes	N/A	0.716	1.212	2.018	2.888	3.987	6.413
Sherwood Medical Monoject Syringes	0.173	0.622	1.263	1.977	3.308	4.474	5.545
Terumo Corporation	0.175	0.650 (2.5 cc)	N/A	1.947	N/A	4.174 (35 cc)	6.673 (60 cc)
	SYRINGE SIZE						
	0.05 cc	0.10 cc	0.25 cc	0.50 cc	1 cc	2.5 cc	5 cc
Hamilton Company	0.008	0.017	0.042	0.083	0.167	0.417	0.833
Unimetrics Corporation	0.008	0.017	0.042	0.083	0.167	N/A	N/A

APPENDIX B

E73-02 SELECTABLE SPEED SETTINGS

Pump Setting	RPM	Pump Setting	RPM	Pump Setting	RPM
01	0.02	34	0.68	67	1.34
02	0.04	35	0.70	68	1.36
03	0.06	36	0.72	69	1.38
04	0.08	37	0.74	70	1.40
05	0.10	38	0.76	71	1.42
06	0.12	39	0.78	72	1.44
07	0.14	40	0.80	73	1.46
08	0.16	41	0.82	74	1.48
09	0.18	42	0.84	75	1.50
10	0.20	43	0.86	76	1.52
11	0.22	44	0.88	77	1.54
12	0.24	45	0.90	78	1.56
13	0.26	46	0.92	79	1.58
14	0.28	47	0.94	80	1.60
15	0.30	48	0.96	81	1.62
16	0.32	49	0.98	82	1.64
17	0.34	50	1.00	83	1.66
18	0.36	51	1.02	84	1.68
19	0.38	52	1.04	85	1.70
20	0.40	53	1.06	86	1.72
21	0.42	54	1.08	87	1.74
22	0.44	55	1.10	88	1.76
23	0.46	56	1.12	89	1.78
24	0.48	57	1.14	90	1.80
25	0.50	58	1.16	91	1.82
26	0.52	59	1.18	92	1.84
27	0.54	60	1.20	93	1.86
28	0.56	61	1.22	94	1.88
29	0.58	62	1.24	95	1.90
30	0.60	63	1.26	96	1.92
31	0.62	64	1.28	97	1.94
32	0.64	65	1.30	98	1.96
33	0.66	66	1.32	99	1.98

APPENDIX C

E73-05 SELECTABLE SPEED SETTINGS

Pump Setting	RPM	Pump Setting	RPM	Pump Setting	RPM
01	0.05	34	1.70	67	3.35
02	0.10	35	1.75	68	3.40
03	0.15	36	1.80	69	3.45
04	0.20	37	1.95	70	3.50
05	0.25	38	1.90	71	3.55
06	0.30	39	1.95	72	3.60
07	0.35	40	2.00	73	3.65
08	0.40	41	2.05	74	3.70
09	0.45	42	2.10	75	3.75
10	0.50	43	2.15	76	3.80
11	0.55	44	2.20	77	3.85
12	0.60	45	2.25	78	3.90
13	0.65	46	2.30	79	3.95
14	0.70	47	2.35	80	4.00
15	0.75	48	2.40	81	4.04
16	0.80	49	2.45	82	4.10
17	0.85	50	2.50	83	4.15
18	0.90	51	2.55	84	4.20
19	0.95	52	2.60	85	4.25
20	1.00	53	2.65	86	4.30
21	1.05	54	2.70	87	4.35
22	1.10	55	2.75	88	4.40
23	1.15	56	2.80	89	4.45
24	1.20	57	2.85	90	4.50
25	1.25	58	2.90	91	4.55
26	1.30	59	2.95	92	4.60
27	1.35	60	3.00	93	4.65
28	1.40	61	3.05	94	4.70
29	1.45	62	3.10	95	4.75
30	1.50	63	3.15	96	4.80
31	1.55	64	3.20	97	4.85
32	1.60	65	3.25	98	4.90
33	1.65	66	3.30	99	4.95

APPENDIX D

E73-02 VOLTAGE INPUT FOR PROGRAMMABLE SPEED SETTINGS

DC*		DC*		DC*	
VOLTS	RPM	VOLTS	RPM	VOLTS	RPM
0.0252	0.02	0.8568	0.68	1.6884	1.34
0.0504	0.04	0.8820	0.70	1.7136	1.36
0.0756	0.06	0.9072	0.72	1.7388	1.38
0.1008	0.08	0.9324	0.74	1.7640	1.40
0.1260	0.10	0.9576	0.76	1.7892	1.42
0.1512	0.12	0.9828	0.78	1.8144	1.44
0.1764	0.14	1.0080	0.80	1.8396	1.46
0.2016	0.16	1.0332	0.82	1.8648	1.48
0.2268	0.18	1.0584	0.84	1.8900	1.50
0.2520	0.20	1.0836	0.86	1.9152	1.52
0.2772	0.22	1.1088	0.88	1.9404	1.54
0.3024	0.24	1.1340	0.90	1.9656	1.56
0.3276	0.26	1.1592	0.92	1.9908	1.58
0.3528	0.28	1.1844	0.94	2.0160	1.60
0.3780	0.30	1.2096	0.96	2.0412	1.62
0.4032	0.32	1.2348	0.98	2.0664	1.64
0.4284	0.34	1.2600	1.00	2.0916	1.66
0.4536	0.36	1.2852	1.02	2.1168	1.68
0.4788	0.38	1.3104	1.04	2.1420	1.70
0.5040	0.40	1.3356	1.06	2.1672	1.72
0.5292	0.42	1.3608	1.08	2.1924	1.74
0.5544	0.44	1.3860	1.10	2.2176	1.76
0.5796	0.46	1.4112	1.12	2.2428	1.78
0.6048	0.48	1.4364	1.14	2.2680	1.82
0.6300	0.50	1.4616	1.16	2.3184	1.84
0.6552	0.52	1.4868	1.18	2.3436	1.86
0.6804	0.54	1.5120	1.20	2.3688	1.88
0.7056	0.56	1.5372	1.22	2.3940	1.90
0.7308	0.58	1.5624	1.24	2.4192	1.92
0.7560	0.60	1.5876	1.26	2.4444	1.94
0.7812	0.62	1.6128	1.28	2.4696	1.96
0.8064	0.64	1.6380	1.30	2.4948	1.98
0.8316	0.66	1.6632	1.32		

* Voltage values are approximate and rounded

APPENDIX E

E73-05 VOLTAGE INPUT FOR PROGRAMMABLE SPEED SETTINGS

DC*		DC*		DC*	
VOLTS	RPM	VOLTS	RPM	VOLTS	RPM
0.0252	0.05	1.0332	2.05	2.0412	4.10
0.0504	0.10	1.0584	2.10	2.0664	4.15
0.0756	0.15	1.0836	2.15	2.0916	4.20
0.1008	0.20	1.1088	2.20	2.1168	4.25
0.1260	0.25	1.1340	2.25	2.1420	4.30
0.1512	0.30	1.1592	2.30	2.1672	4.35
0.1764	0.35	1.1844	2.35	2.1924	4.40
0.2016	0.40	1.2096	2.40	2.2176	4.45
0.2268	0.45	1.2348	2.45	2.2428	4.50
0.2520	0.50	1.2600	2.50	2.2680	4.55
0.2772	0.55	1.2852	2.55	2.3184	4.60
0.3024	0.60	1.3104	2.60	2.3436	4.65
0.3276	0.65	1.3356	2.65	2.3688	4.70
0.3528	0.70	1.3608	2.70	2.3940	4.75
0.3780	0.75	1.3860	2.75	2.4192	4.80
0.4032	0.80	1.4112	2.80	2.4444	4.85
0.4284	0.85	1.4364	2.85	2.4696	4.90
0.4536	0.90	1.4616	2.90	2.4948	4.95
0.4788	0.95	1.4868	2.95		
0.5040	1.00	1.5120	3.00		
0.5292	1.05	1.5372	3.05		
0.5544	1.10	1.5624	3.10		
0.5796	1.15	1.5876	3.15		
0.6048	1.20	1.6128	3.25		
0.6300	1.25	1.6380	3.30		
0.6552	1.30	1.6632	3.35		
0.6804	1.35	1.6884	3.40		
0.7056	1.40	1.7136	3.45		
0.7308	1.45	1.7388	3.50		
0.7560	1.50	1.7640	3.55		
0.7812	1.55	1.7892	3.60		
0.8064	1.60	1.8144	3.65		
0.8316	1.65	1.8396	3.70		
0.8568	1.70	1.8648	3.75		
0.8820	1.75	1.8900	3.80		
0.9072	1.80	1.9152	3.85		
0.9324	1.85	1.9404	3.90		
0.9576	1.90	1.9656	3.95		
0.9828	1.95	1.9908	4.00		
1.0080	2.00	2.0160	4.05		

* Voltage values are approximate and rounded