EDULABS DIDACTIC

POWER ELECTRONICS TRAINER

EXPERIMENT 26

EXPERIMENTS MANUAL

Objectives: The trainee is able to

1. Acquaintance the principle of H-Bridge converter
2. Measure the quantities and direction of output voltage and current

Experiments Lists

1. Experiment 26.1: The output voltage of H-Bridge converter
2. Experiment 26.2: The output current of H-Bridge converter

Theory

The H-Bridge converter is a double direction output current converter and adjustable output voltage. The circuit diagram of H-Bridge consists of two IGBT circuits (T1-T3 and T2-T4) as shown on fig. 26.1. To prevent the short circuit each IGBT is fired separately.

The H-Bridge converter is control by firing pulse of the duty cycle and the direction of current will be assigned by the ON time of each IGBT, if firing the T1 and T2 current will flow from left side to right of the picture, on the contrary the direction of current will flow from right to left if the T3 and T4 are operate. The quantities of output voltage can be varying by control the ON time of IGBT.

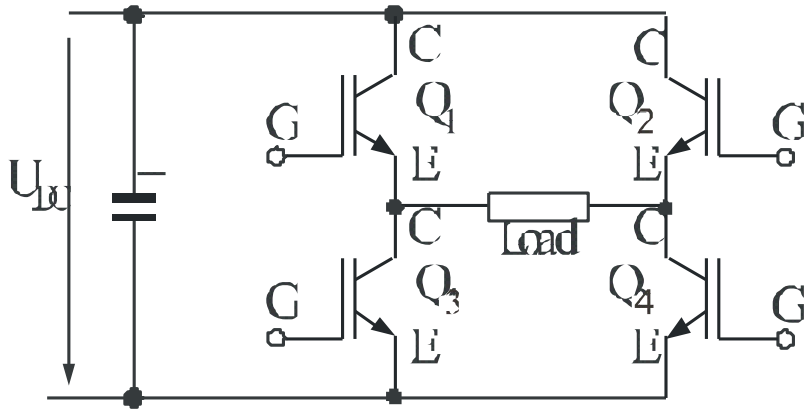


Figure 26.1 the H-Bridge converter circuit

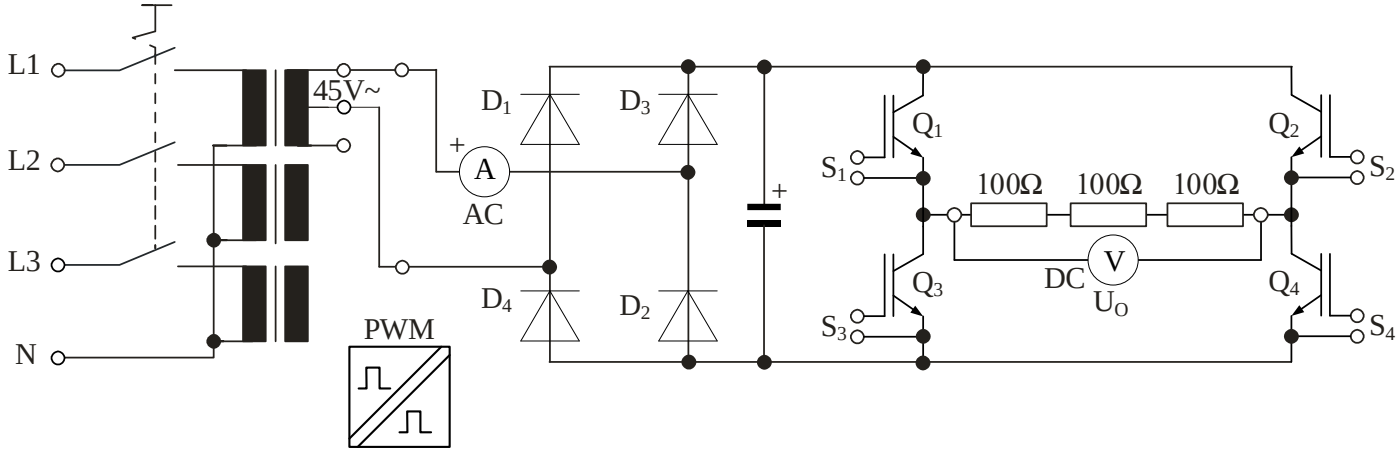
Equipment Requirement

No.	Item	Model	Quantity
1	Group of Diode Module	EM-21-01-03	1
2	IGBT Chopper / Inverter Chopper	EM-21-01-11	1
3	PWM Controller	EM-21-02-03	1
4	Resistive Load Module (I)	EM-21-03-01	1
5	Capacitive Load Module	EM-21-03-03	1
6	Three Phase AC Power Supply	EM-21-04-01	1
7	DC Power Supply	EM-21-04-02	1
8	4mm Safety Stackable Connecting Lead Set	EM-21-12-01	1 Set
9	DC Voltmeter	EM-30-13-01	1
10	DC Ammeter	EM-30-13-02	1
11	4mm Stackable Connecting Lead Set	EM-30-15-12	1 Set
12	19mm Shunt Plug Set	PTL-2170	2
13	Digital Storage Oscilloscope	TDS-2102C	1

Procedure

Experiment 26.1: The output voltage of H-Bridge converter

1. Construct the circuit according to circuit diagram Figure 26.1.



2. PWM Controller setting:
   - Frequency Range = **X10 (CHANGE FROM X100 TO X10 TO PREVENT HIGH CURRENT FLOW WHEN ADJUST THE HZ KNOB TO MAXIMUM, TRNAFORMER OUTPUT CURRENT MAY UP TO 1.5A AC AND BURN THE TRANSFORMER (0-45VAC)**
   - Frequency Adjust = 200Hz
3. Connect the voltage supply $\pm 15\,V$ to PWM controller.
4. Connect S1 of Q1 to S1 of PWM controller.
5. Connect S4 of Q4 to S4 of PWM controller.
6. Connect S2 of Q2 to S2 of PWM controller.
7. Connect S3 of Q3 to S3 of PWM controller.
8. Adjust the duty cycle of PWM generators at t_{on} = 0% in **forward mode**.
9. Turn ON power supply for PWM Controller before rectifier circuit.
10. Measure and record the quantities and direction of output voltage in Experimental Table 26.1.1;
11. Change the duty cycle as t_{on} = 0% in **reverse mode** to measure and record the corresponding voltage in Experimental Table 26.1.2, relatively;
12. Turn OFF power supply.

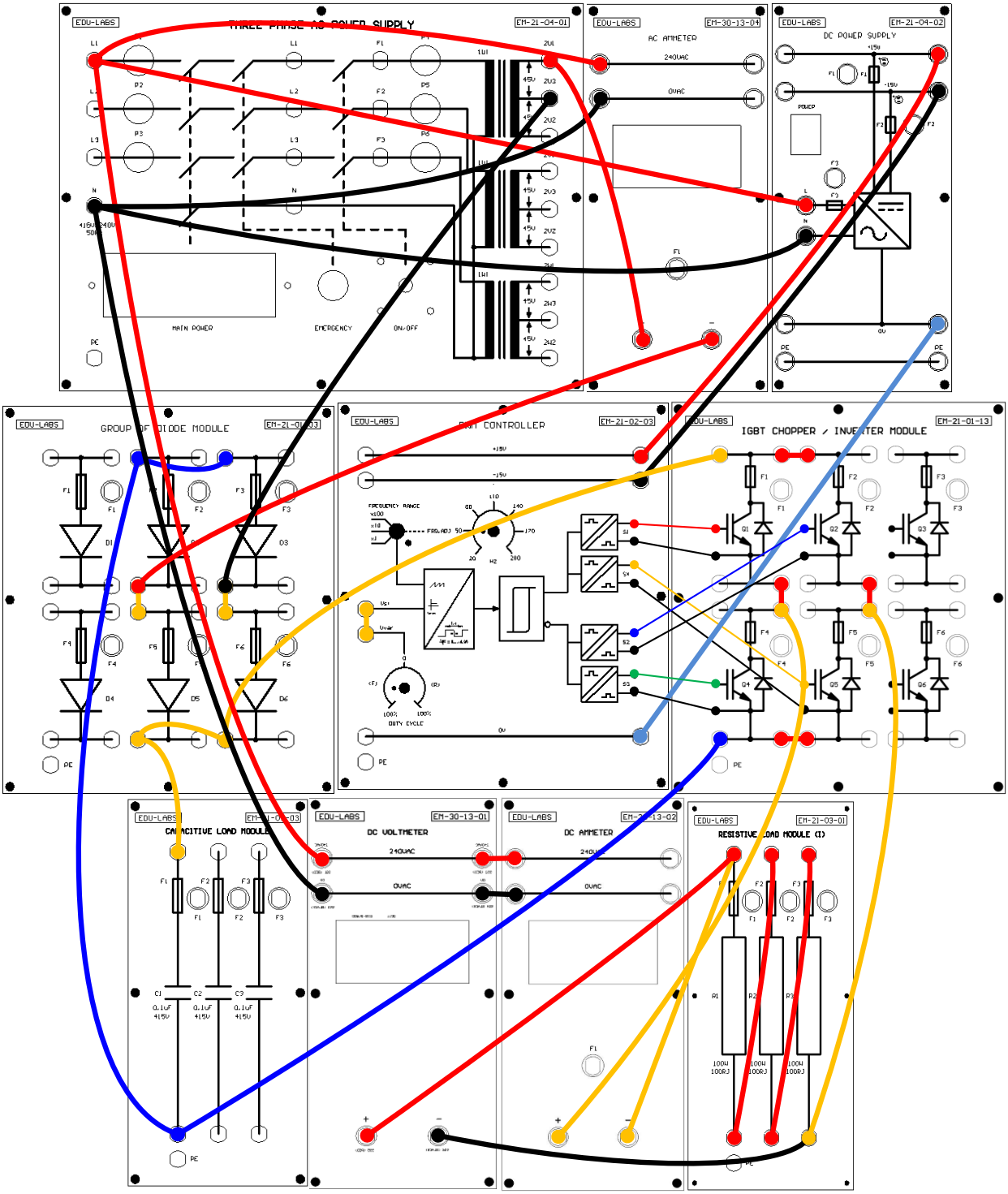


Figure 26.1 Circuit diagram for measure the output voltage

Experimental Table 26.1.1

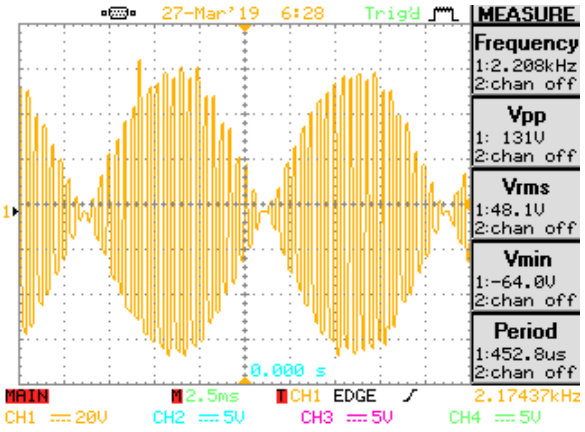
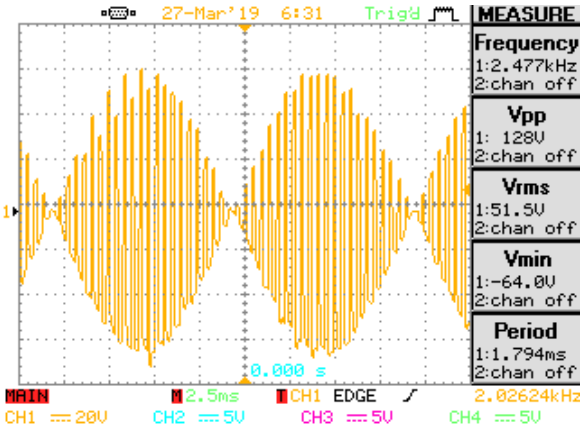
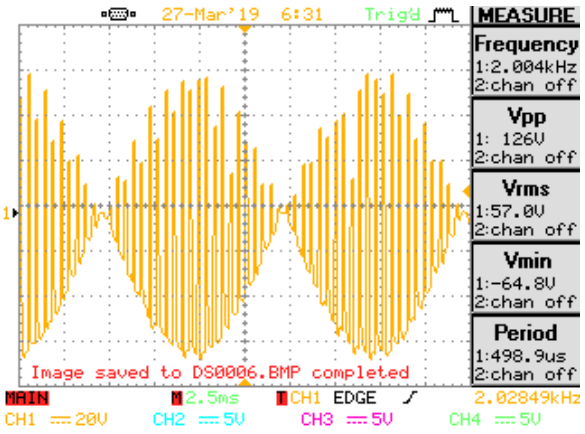
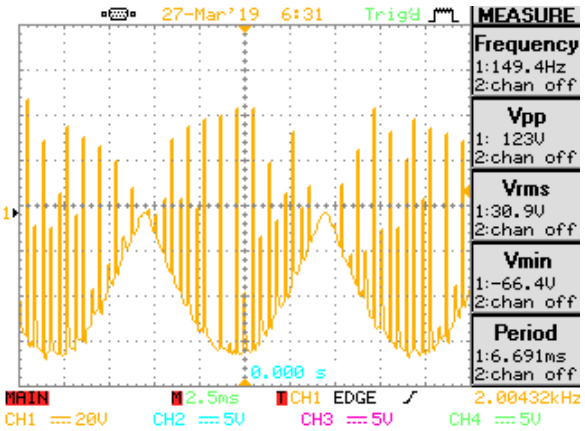
Duty Cycle (%)*	Vo (V)	Direction (+/-)	Waveform at Load
0			
20(F)			
40(F)			
60(F)			
80(F)			
100(F)			

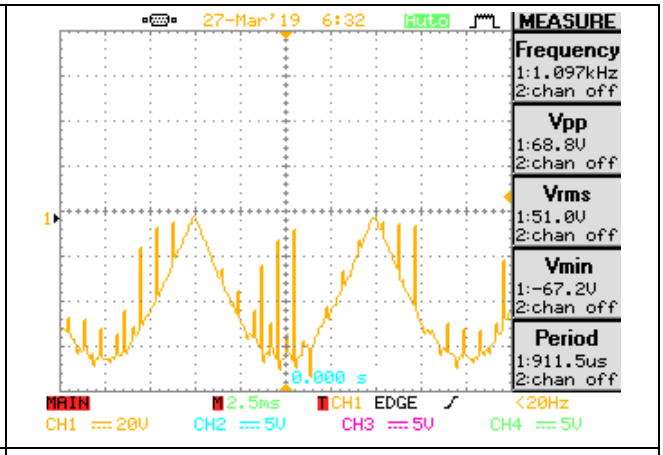
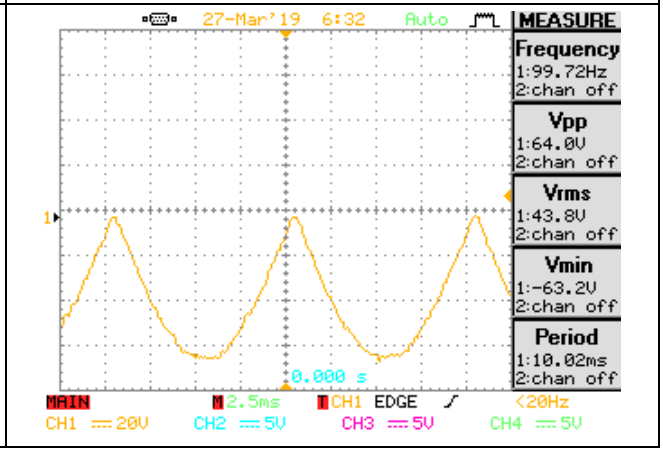
Experimental Table 26.1.2

Duty Cycle (%)*	Vo (V)	Direction (+/-)	Waveform at Load
0			
20(R)			
40(R)			
60(R)			
80(R)			
100(R)			

Note*: Adjust in approximate scale.

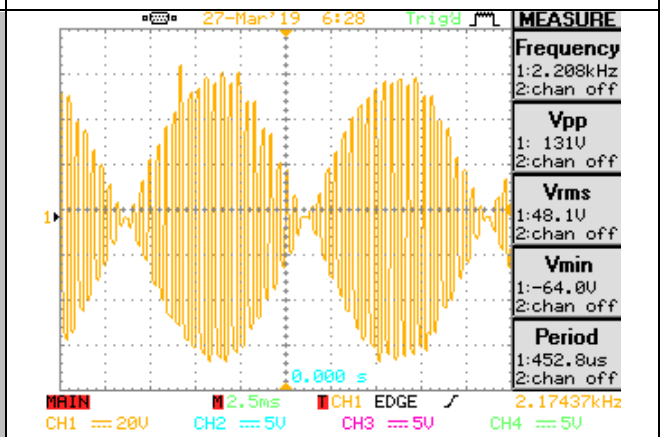
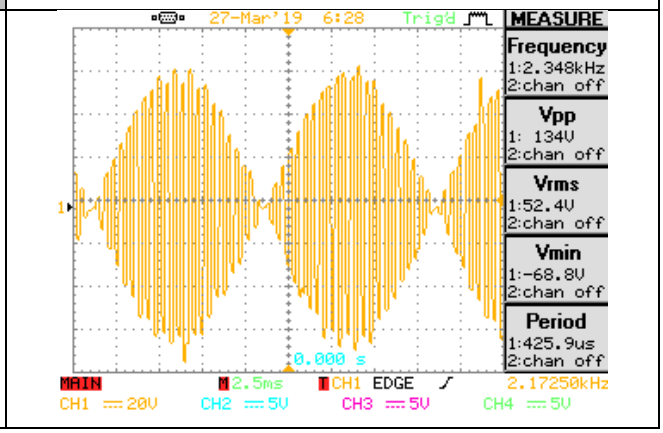
Expected Result Table 26.1.1

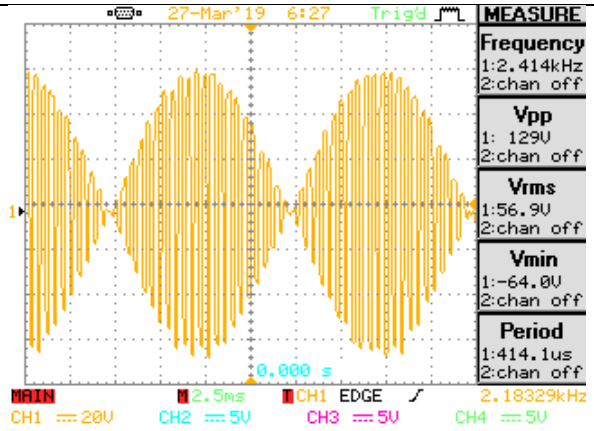
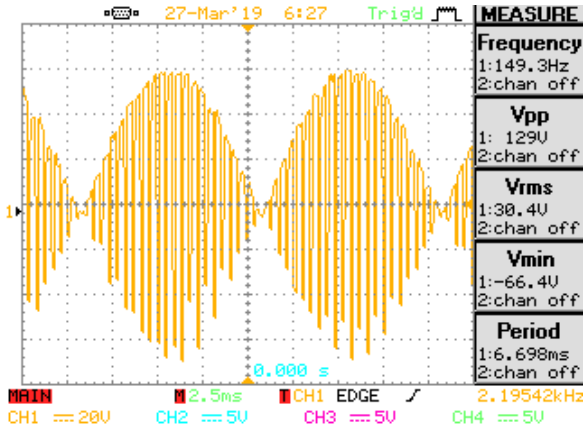
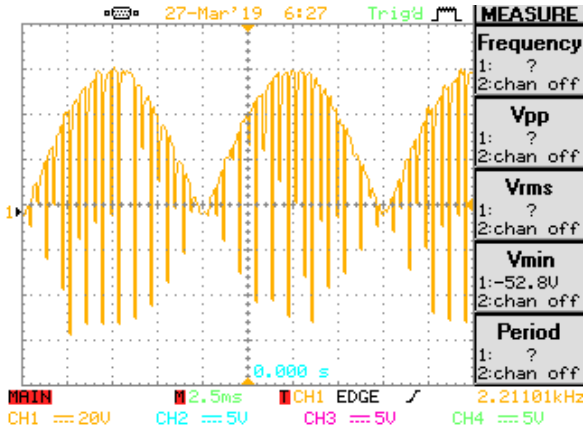
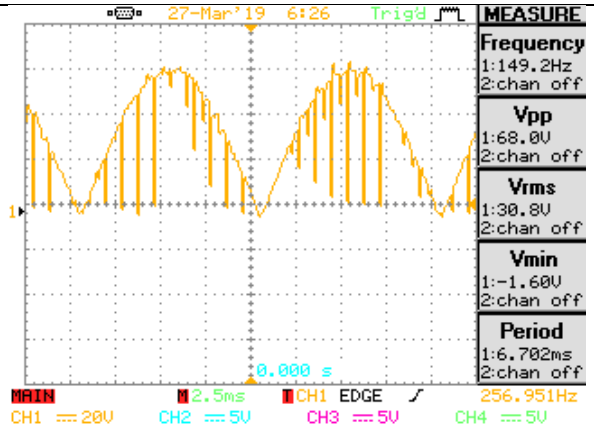
Duty Cycle (%)*	Vo (V)	Direction (+/-)	Waveform at Load
0	0		
20(F)	7	-	
40(F)	13	-	
60(F)	25	-	

80(F)	40	-	
100(F)	39	-	

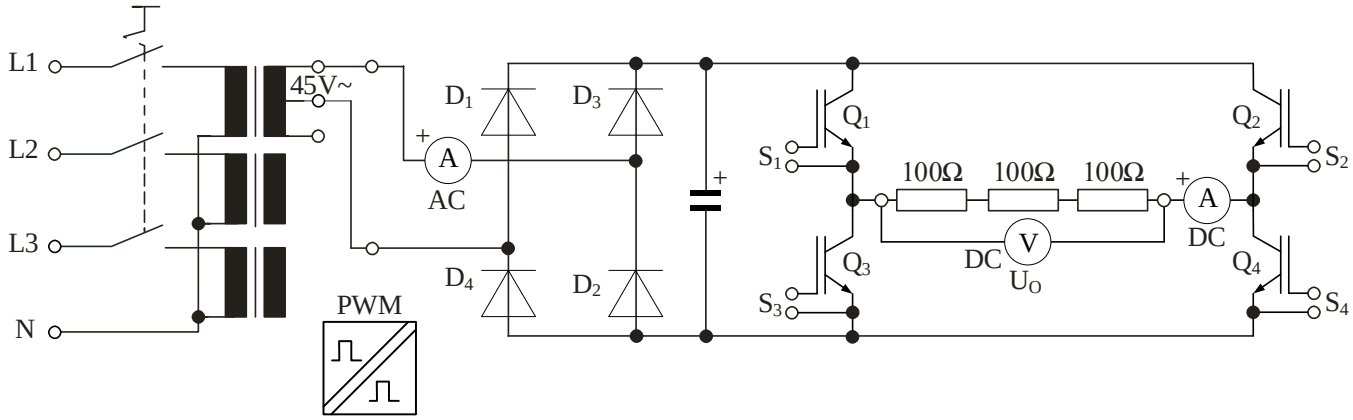
Note*: Adjust in approximate scale.

Expected Result Table 26.1.2

Duty Cycle (%)*	Vo (V)	Direction (+/-)	Waveform at Load
0	0		
20(R)	8	+	

40(R)	16	+	
60(R)	27	+	
80(R)	37	+	
100(R)	40	+	

Experiment 26.2: The output current of H-Bridge converter



1. Construct the circuit according to circuit diagram Figure 26.2.
2. PWM Controller setting:
   - Frequency Range = X10
   - Frequency Adjust = 200Hz
3. Connect the voltage supply $\pm 15\,V$ to PWM controller.
4. Connect S1 of Q1 to S1 of PWM controller.
5. Connect S4 of Q4 to S4 of PWM controller.
6. Connect S2 of Q2 to S2 of PWM controller.
7. Connect S3 of Q3 to S3 of PWM controller.
8. Adjust the duty cycle of PWM generators at t_{on} = 0% in **forward mode**.
9. Turn ON power supply of rectifier circuit and PWM Controller.
10. Measure and record the quantities and direction of output current in Experiment Table 26.2.1;
11. Change the duty cycle as t_{on} = 0% in **reverse mode** to measure and record the current in Experimental Table 26.2.2, relatively.
12. Vary the duty cycle in range of 0 % to 100 % on each mode (Forward/Reverse) to observe the effect of current flow.
13. Turn OFF power supply.

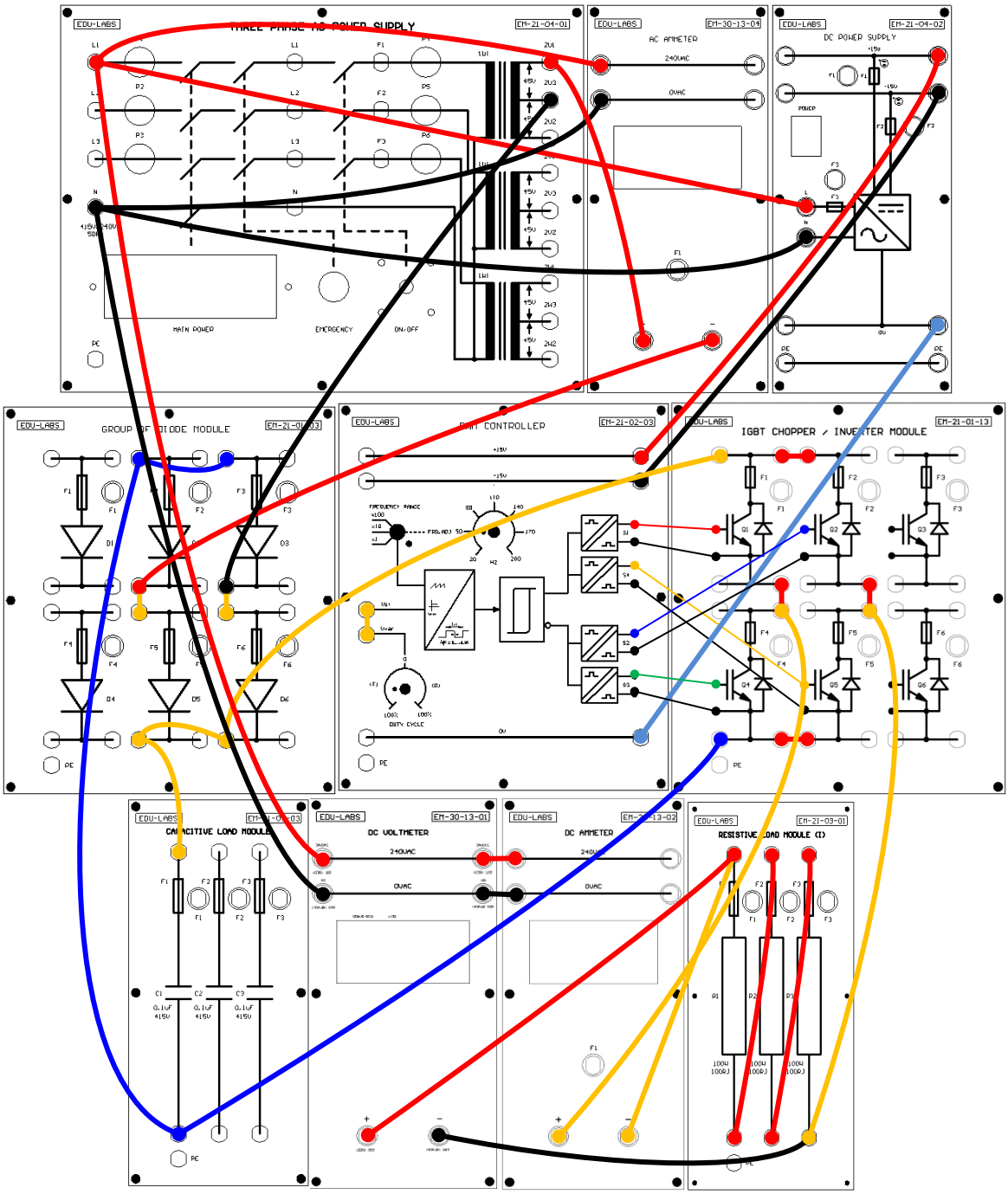


Figure 26.2 Circuit diagram for measure the output current

Experimental Table 26.2.1

Duty Cycle (%)*	Io (A)	Direction (+/-)
0		
20(F)		
40(F)		
60(F)		
80(F)		
100(F)		

Note*: Adjust in approximate scale.

Expected Result Table 26.2.1

Duty Cycle (%)*	Io (A)	Direction (+/-)
0	0	
20(F)	0.04	-
40(F)	0.07	-
60(F)	0.13	-
80(F)	0.19	-
100(F)	0.20	-

Note*: Adjust in approximate scale.

Experimental Table 26.2.2

Duty Cycle (%)*	Io (A)	Direction (+/-)
0		
20(R)		
40(R)		
60(R)		
80(R)		
100(R)		

Note*: Adjust in approximate scale.

Expected Result Table 26.2.2

Duty Cycle (%)*	Io (A)	Direction (+/-)
0	0	
20(R)	0.04	+
40(R)	0.09	+
60(R)	0.16	+
80(R)	0.20	+
100(R)	0.21	+

Note*: Adjust in approximate scale.

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