



flexiBRUTE Universal DRSSTC Controller

Introduction

The flexiBRUTE Universal DRSSTC Controller is an advanced driver system for Double Resonant Solid State Tesla Coils (DRSSTCs). The controller is a complete solution designed to operate with both low power and high power DRSSTC systems. Advanced synchronous logic ensures that hard switching is eliminated and that IGBTs are continuously soft-switched, even during fault conditions. High current, dual channel gate drivers allow the use of both low power IGBTs and high power industrial IGBTs such as CM300 and CM600 power modules in both half-bridge and full-bridge configurations. Onboard LED indicators continuously provide the user with operational feedback to the status of the system and to alert the user if any faults have occurred.

Features:

- Dual channel gate drive outputs
- >20A peak current per channel
- 15V-24V output gate voltage (adjustable)
- Fiber optic / BNC modulator inputs
- LED status for power and fault conditions
- Overcurrent detection and pulse inhibit
- Max. pulsewidth detection and truncation
- Output drive phase delay adjustment
- Modulator input mode select
- Output gate drive phase select
- Current monitor output
- D-Subminiature I/O connectors
- Terminal block outputs (optional)
- Shielded, metal enclosure

Gate Drive Outputs

There are two high current (2) gate drive output channels provided. Both output channels are driven with the same polarity, although the polarity can be reversed by reversing the windings on the gate drive transformers. Maximum peak switching current of the gate drivers exceeds 20A per channel and output gate voltage can be adjusted from 15-24VDC.

Overcurrent Protection

Onboard circuitry monitors the peak primary current on a pulse-by-pulse basis and will disable switching to the IGBTs in the event the user programmable current limit is exceeded. Synchronized circuitry ensures that switching to the IGBTs is disabled only at the end of the current output pulse to ensure that IGBTs are not hard switched and that IGBTs are disabled only when voltage and current through the IGBT is at zero. This limits inductive voltage spikes which could damage the IGBTs.

Maximum Pulsewidth Protection

Pulsewidth protection circuitry monitors each input modulator pulse and compares it to a user programmable maximum pulsewidth limit. If the modulator pulsewidth exceeds the preset maximum pulsewidth limit, the output pulse will be truncated to the maximum pulsewidth length. This ensures that the output of the controller will never operate at high or 100% duty (CW.) Specialized logic also ensures that the output pulse cannot be retrigged during a fault condition.

LED Status

There are five (5) LEDs which provide status to the user:

- Gate power status
- Logic power status
- Overcurrent fault
- Pulsewidth fault
- Modulator input active

Output Drive Phase Delay Adjustment

Phase delay adjustment allows the user to vary the phase of the input current feedback signal to match the turn-on / turn-off characteristics of the IGBTs being used to ensure that the devices are soft-switching – that is switching when the current through the IGBTs is at zero.

Modulator Input Mode Select

Onboard DIP switches allow the user to specify the type of modulator input being used in the controller. There are three specific modes that can be selected:

- Fiber optic only
- BNC only
- Fiber optic and BNC (inputs are OR'd together)

Output Phase Select

An onboard switch allows the user to switch the phasing of the output gate drive channels without the need for physically removing and switching wires. Both output gate channels can be switched by 180 degrees.

Input Connections

MOD IN



J4

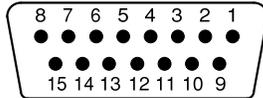


J1

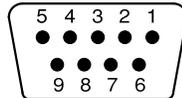
Pin	Function
J1-1	Modulator Input +
J1-2	Modulator Input – (Shield)

Pin	Function
J4	Modulator Input (Fiber Optic)

Output Connections



GATE DRV, J2



CTRL, J3

Pin	Function
J2-1	Power In +
J2-2	NC
J2-3	NC
J2-4	Channel 1 Output B
J2-5	Channel 1 Output A
J2-6	NC
J2-7	Channel 2 Output A
J2-8	Channel 2 Output B
J2-9	Power In -
J2-10	
J2-11	Channel 1 Output B
J2-12	Channel 1 Output A
J2-13	
J2-14	Channel 2 Output A
J2-15	Channel 2 Output B

Pin	Function
J3-1	Current Feedback +
J3-2	NC
J3-3	Current Sense +
J3-4	Aux. +9VDC
J3-5	Current Monitor
J3-6	Current Feedback -
J3-7	NC
J3-8	Current Sense -
J3-9	GND

Modulator Input (J4) – Fiber Optic

J4 is the fiber optic modulator input which is an Agilent HFBR2412T fiber optic receiver. The fiber optic connector is an ST type connection and we recommend using an Agilent HFBR1412T (or similar) fiber optic transmitter if using your own modulator in MIDI interface.

Modulator Input (J1) – BNC

J1 is the electrical modulator input which is a standard female BNC connector. Signal level for the modulator should be TTL compatible with a maximum voltage of 5V. There is a voltage divider onboard which can allow the use of higher modulator input voltages.

Power Input

POWER IN + (Pin J2-1): This can be connected to either an AC or DC voltage source as indicated in the table below. If using a DC power source, this pin would be connected to the positive of the DC power source.

POWER IN - (Pin J2-9): This can be connected to either an AC or DC voltage source as indicated in the table below. If using a DC power source, this pin would be connected to the negative of the DC power source.

Power Type	Input Range
AC	18-20VAC, 1A
DC	26-30VDC, 1A

Current Feedback

Current Feedback + (Pin J3-1): This connects to the positive terminal of the current feedback transformer. The current feedback transformer provides the switching drive signal by sensing current on the primary of the DRSSTC.

Current Feedback - (Pin J3-6): This connects to the negative terminal of the current feedback transformer. The current feedback transformer provides the switching drive signal by sensing current on the primary of the DRSSTC.

Current Sense

Current Sense + (Pin J3-3): This connects to the positive terminal of the current sense transformer. The current sense transformer samples peak primary current of the DRSSTC and is used for overcurrent detection and pulse inhibit.

Current Sense - (Pin J3-8): This connects to the negative terminal of the current sense transformer. The current sense transformer samples peak primary current of the DRSSTC and is used for overcurrent detection and pulse inhibit.



Current Monitor

Current Monitor (Pin J3-5): This pin provides a DC level output which indicates the peak current in the primary coil. This pin is designed to be used with external meters or displays to provide the user with an indication of the primary current level.

Aux. +9VDC (Pin J3-4): This output provides an auxiliary +9VDC to be used for external metering equipment or other applications. Maximum output current on this pin should be less than 100mA.

GND (Pin J3-9): This pin provides the RTN for the Current Monitor output and is tied directly to the GND on the controller PCB board.

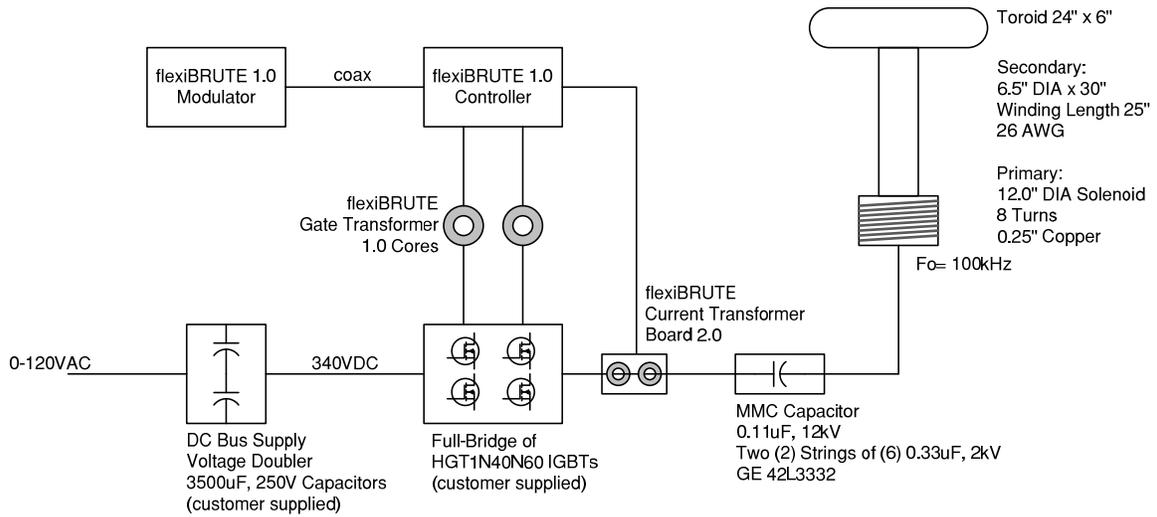
Gate Drive Output Channels

Channel 1 Output A (Pin J2-5, J2-12): These pins are the positive output of the high current gate drive for Channel A. Two pins are provided for maximum current capability as well as flexibility in driving multiple transformers.

Channel 1 Output B (Pin J2-4, J2-11): These pins are the negative output of the high current gate drive for Channel A. Two pins are provided for maximum current capability as well as flexibility in driving multiple transformers.

Channel 2 Output A (Pin J2-7, J2-14): These pins are the positive output of the high current gate drive for Channel B. Two pins are provided for maximum current capability as well as flexibility in driving multiple transformers.

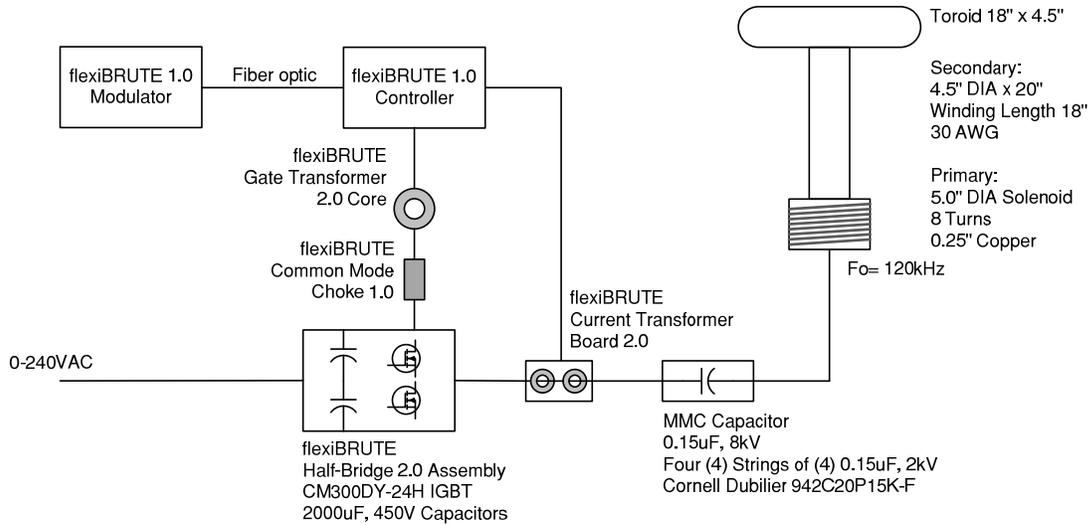
Channel 2 Output B (Pin J2-8, J2-15): These pins are the negative output of the high current gate drive for Channel B. Two pins are provided for maximum current capability as well as flexibility in driving multiple transformers.



Component	QTY
flexiBRUTE 1.0 Modulator	1
flexiBRUTE 1.0 Universal Controller	1
flexiBRUTE Gate Transformer 1.0 Core	2
flexiBRUTE Current Transformer Board 2.0	1

flexiBRUTE Components used for this specific application.

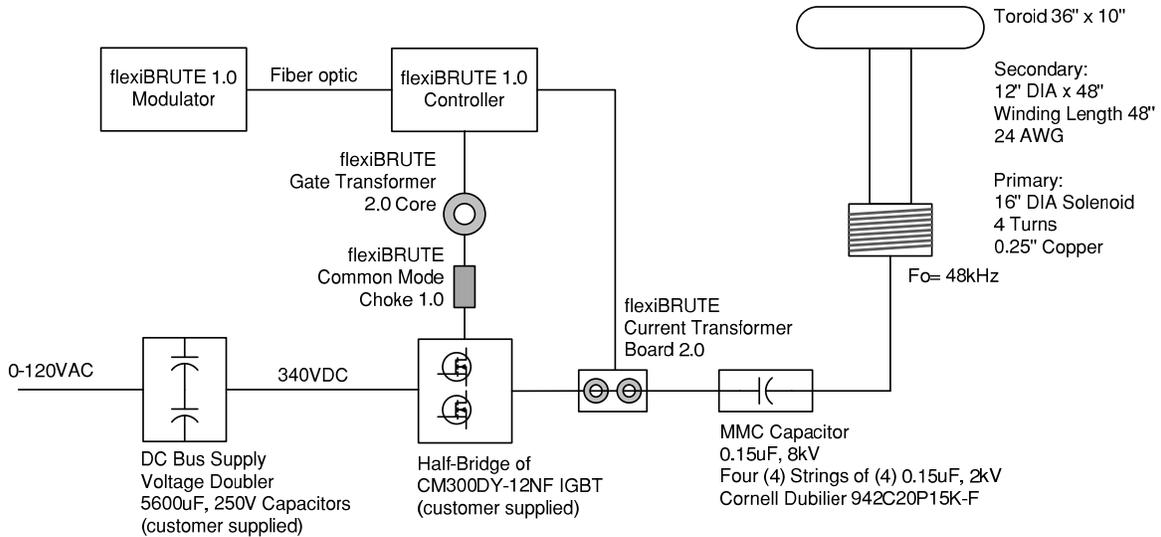
Reference Design 1



Component	QTY
flexiBRUTE 1.0 Modulator	1
flexiBRUTE 1.0 Universal Controller	1
flexiBRUTE Half-Bridge 2.0 Assembly	1
flexiBRUTE Gate Transformer 2.0 Core	1
flexiBRUTE Common Mode Choke 1.0	1
flexiBRUTE Current Transformer Board 2.0	1

flexiBRUTE Components used for this specific application.

Reference Design 3



Component	QTY
flexiBRUTE 1.0 Modulator	1
flexiBRUTE 1.0 Universal Controller	1
flexiBRUTE Gate Transformer 2.0 Core	1
flexiBRUTE Common Mode Choke 1.0	1
flexiBRUTE Current Transformer Board 2.0	1

flexiBRUTE Components used for this specific application.

Reference Design 4