

TIG

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针对核电厂焊接施工过程中对焊接热输入监控的需求，研制了一种带焊接热输入监控的全数字化 IGBT 逆变 TIG 焊机。该机采用 TMS320F28335 数字信号处理器和 LPC2388FBD144 单片机的 DSP+ARM 双处理器架构，实现了焊机主电路控制、人机交互和对外通讯数字化。焊接过程中焊机自动记录焊接电流、电弧电压及焊接时间，结合手动输入焊缝长度数据，在焊机上实现了焊接热输入值的自动计算和显示；焊接热输入数据可保存在焊机本机或 U 盘，或通过上位机集控系统实现网络传输、监控和保存。试验表明该焊机能够准确记录和监控焊接时的热输入数据，符合核电厂建设的焊接质量管控要求，具有广阔的应用前景。

热输入；数字化；TIG

Development of Full Digital TIG Welding Machine with the Welding Heat Input Monitoring

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Abstract: Aiming at the demand for welding heat input monitoring in the welding construction site of nuclear power plant, a fully digital IGBT inverter TIG welding machine with the welding heat input monitoring was designed and developed. The welding machine adopts DSP+ARM dual processor with TMS320F28335 digital signal processor and LPC2388FBD144 microcomputer, which realizes digitalization of main circuit control, digitization of human-computer interaction and digitization of external interface. By automatically recording the arc voltage, welding current and welding time during the welding process, the length of the weld is manually inputted, and the data of welding heat input

1

TIG

TIG

TMS320F28335

LPC2388

DSP+ARM

IGBT

DSP

ARM

1

| | | | | |
|----|-----|-----------------|-----------|---------|
| | | 1 | | |
| | | U_1 (V) | 380V 15 | 50/60Hz |
| | | U_o (V) | 76 5% | |
| | | | VRD 24 5% | |
| A | MMA | 10~300A | | |
| | TIG | 5~300A | | |
| 40 | | 300A/22V/35% | | |
| | | 180A/27.2V/100% | | |
| kg | | 24kg | | |

DSP+ARM

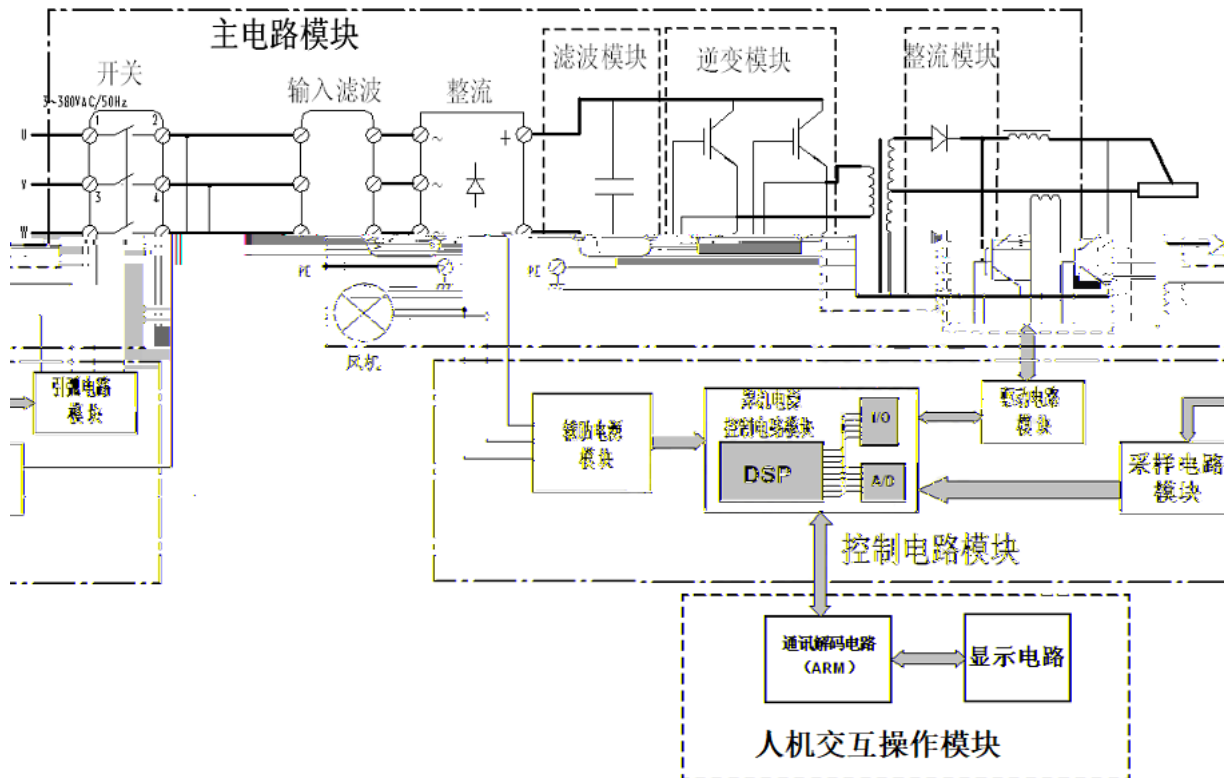
TIG

1

20kHz

TWPM

[6]



1

1.1

380V

IGBT

TMS320F28335

DSP IGBT

ARM

DSP

DSP

A/D DSP PID
 PWM IGBT

1.2

3

MCU

ARM

LPC2388

USB

CAN

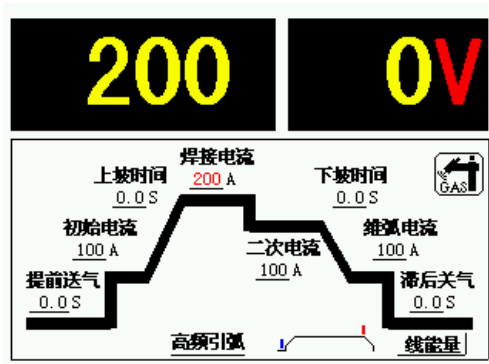
CAN

485

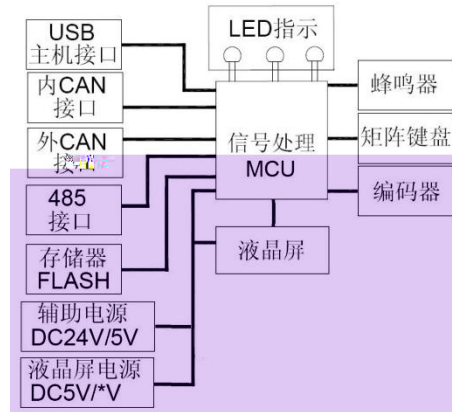
FLASH

LED

2



2



3

1.3

USB CAN

U

USB

U

U

TWPM

CAN

CAN

CAN

CAN

I/O

RS-485

Modbus-RTU

PLC

CAN

TWPM

2

2.1

4

U / /

P92

2^[8]

Φ 273×150×24 5G / V Thermanit

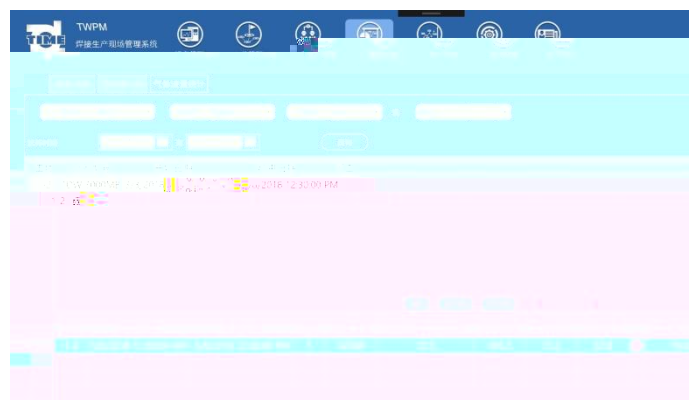
MTS 616 GTAW SMAW 10~15L/min 6 10L/min

3

1 2 1-1 2-1 4-1

0A
0V

| | |
|---|-------------------------------|
| 焊接时间 20.4 min | 时 间 2017-11-02 08:03 |
| 焊接速度 42 mm/min | 图 纸 号 21581121900 |
| 平均电压 12.8 V | 焊 缝 号 123532 |
| 平均电流 120.5 A | 焊 工 号 003538 |
| 线 能 量 | 下 限 值 20 kJ/cm 上 限 值 24 kJ/cm |
| 22.03 kJ/cm | 焊 缝 长 度 557 mm 热 系 数 100 % |
| <input type="button" value="开始"/> <input type="button" value="返回"/> <input type="button" value="优盘"/> <input type="button" value="清空"/> | |



4

5 TWPM

1

| () | | | | (A) | (V) | (mm/min) | (kJ/cm) | |
|-----|------|---------|-------|---------|-------|----------|-----------|--|
| | | () | (mm) | | | | | |
| 1-1 | GTAW | MTS-616 | Φ 2.4 | 105~115 | 11~12 | 33~35 | 19.8~25.1 | |
| 2-1 | GTAW | MTS-616 | Φ 2.4 | 125~130 | 12~13 | 38~40 | 22.5~26.7 | |
| 3-1 | SMAW | MTS-616 | Φ 2.5 | 75~80 | 22~23 | 58~63 | 15.7~19.0 | |
| 4-1 | SMAW | MTS-616 | Φ 2.5 | 78~83 | 23~24 | 58~63 | 17.1~20.6 | |
| 5-1 | SMAW | MTS-616 | Φ 3.2 | 105~120 | 22~25 | 58~61 | 22.7~31.0 | |
| | | | | 25mm | 2.5mm | | | |

2

| () | | (A) | (V) | (mm/min) | (kJ/cm) |
|-----|------|-------|------|----------|---------|
| | | | | | |
| 1-1 | GTAW | 110.0 | 11.2 | 38 | 19.45 |
| 2-1 | GTAW | 125.0 | 12.8 | 42 | 22.03 |
| 3-1 | SMAW | 80.2 | 22.5 | 68 | 15.92 |

| | | | | | |
|-----|------|-------|------|----|-------|
| 4-1 | SMAW | 80.5 | 22.8 | 65 | 16.94 |
| 5-1 | SMAW | 110.1 | 24.4 | 64 | 25.19 |

2.2

TWPM
 CAN-BUS
 Wi-Fi / PC
 PC
 TWPM
 TWPM 5
 excel

3

1 DSP+ARM TIG
 2
 3
 4

[1] , . [J]. , 2015, 32(2) :64-68.

[2] . [M]. , 2004.

[3] , , , . [J]. , 2014, 44(6) :21-25.

[4] . [J]. , 2012, 42(6) :1-3

[5] , . [J]. , 2010, 40(4) :7-10.

[6] , , . [C].

. 2011.

[7] , . [C]. 2007

, 2007: 248-253.