

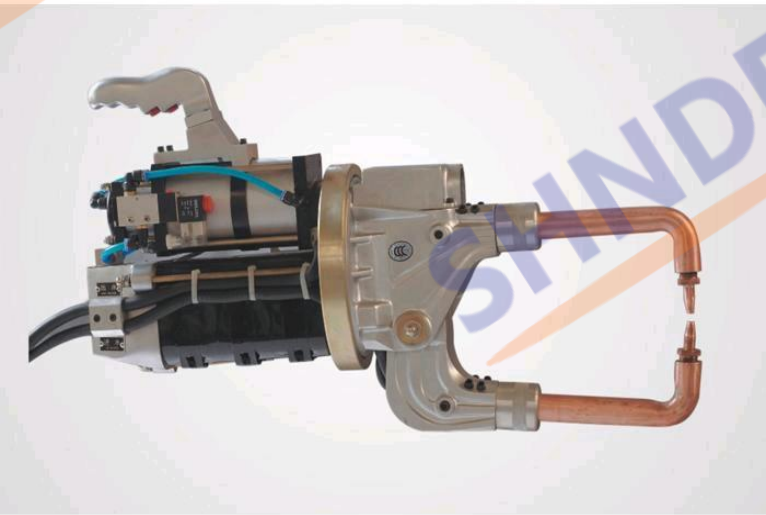
加拿大TESSONICS公司  
RIWA在线超声波焊点检测系统



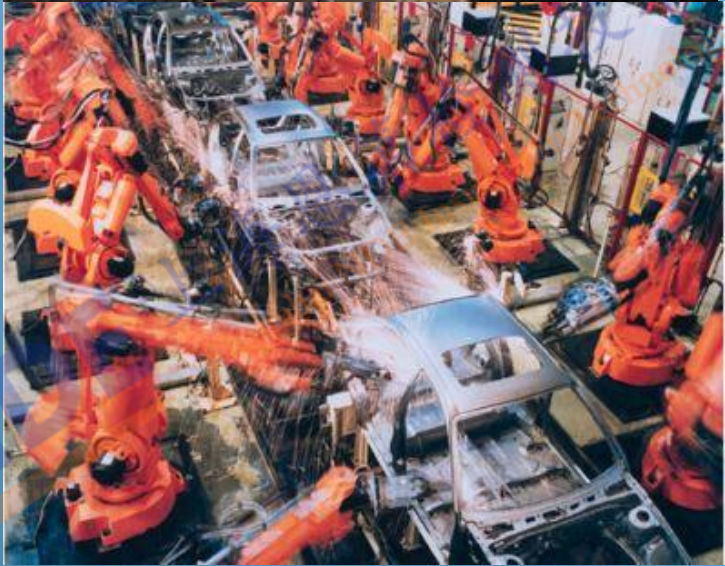
# 工业电阻点焊



乘用车车身约有  
3000~5000个电  
阻点焊的焊点

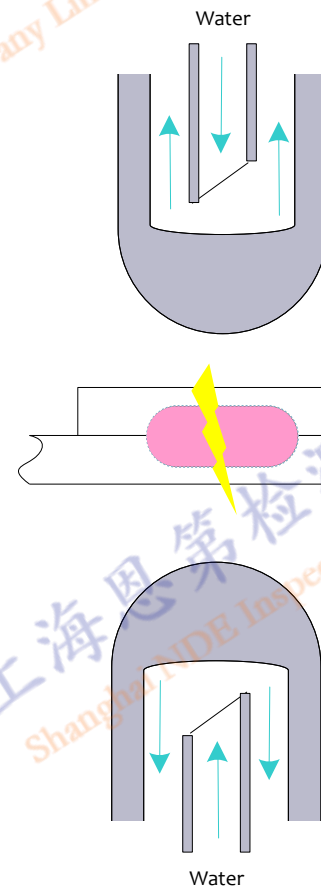


点焊焊接已实现  
高度自动化



# 点焊焊点检测方法

- 电阻点焊——汽车行业最常用的钣金连接方法
- 使用焦耳加热产生电流热量
- 传统的焊点质量检测方式为定期破坏性测试：剥离测试和开凿测试
- 非破坏性的离线超声波检测方法也可用于检查焊点
- 以上两种方法的共同缺点：必须具备离线检测工位以及花费人工成本和时间成本
- 一种先进高效并可实现全检的在线超声波无损检测系统越来越多地被广大主流车企用于点焊焊点质量的评估

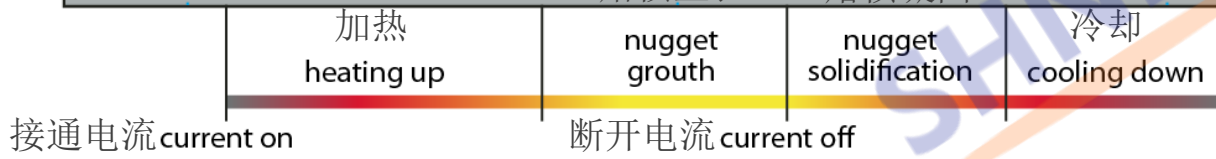
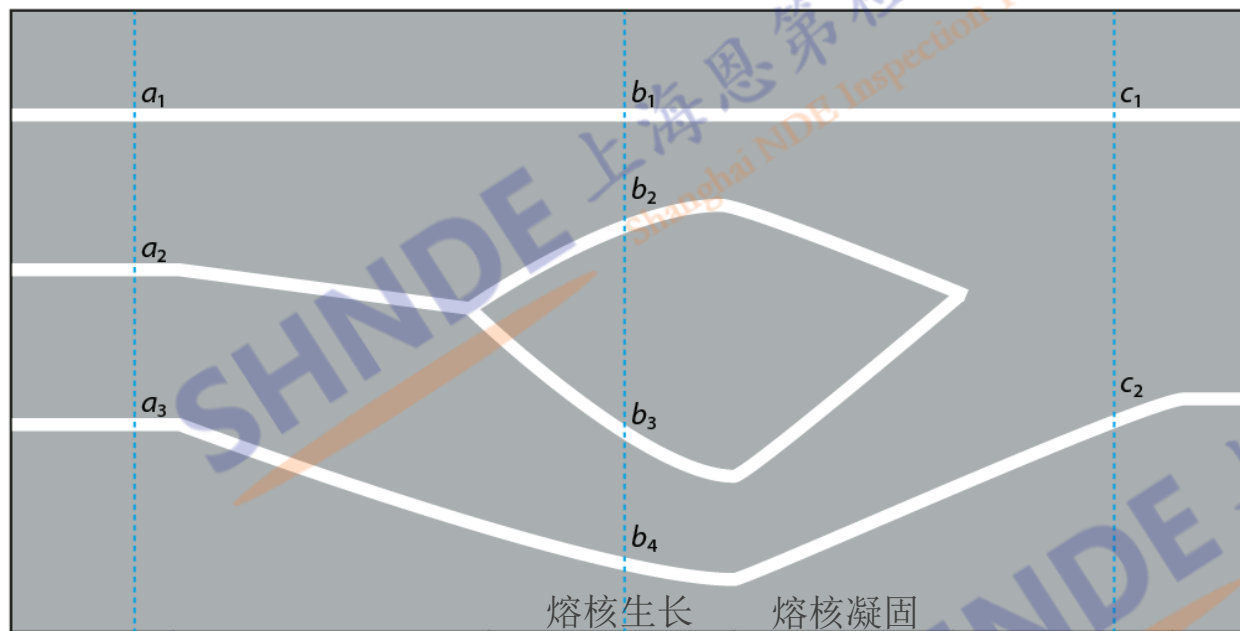
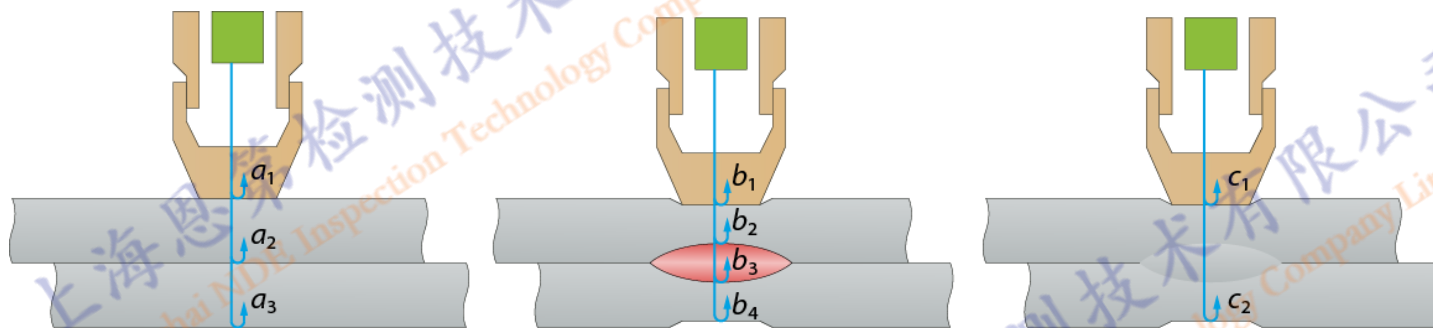


# 工作方式

- 超声波传感器内置在焊枪电极中
- 利用焊枪电极冷却水进行超声波耦合
- 焊接过程中，连续的超声波脉冲信号在焊接时发射到工件内部
- 超声波反射信号被收集和分析
- 通过复杂算法自动评估焊点质量
- 多种传感器设计方案可以适应不同的电极配置
- 对点焊焊接的节拍毫无影响

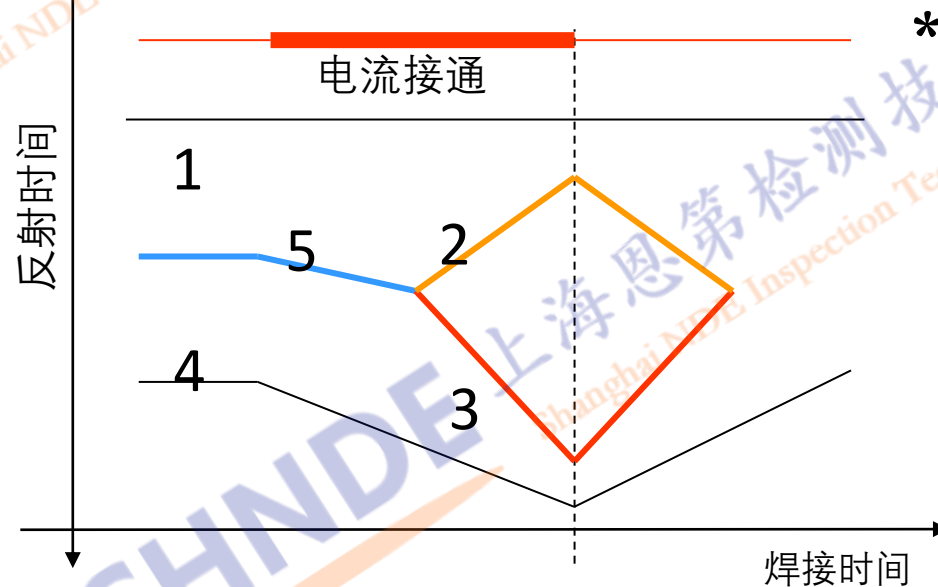
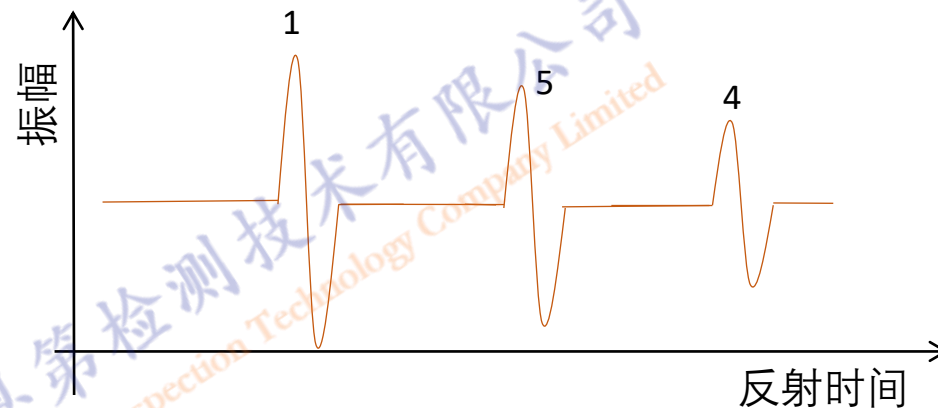
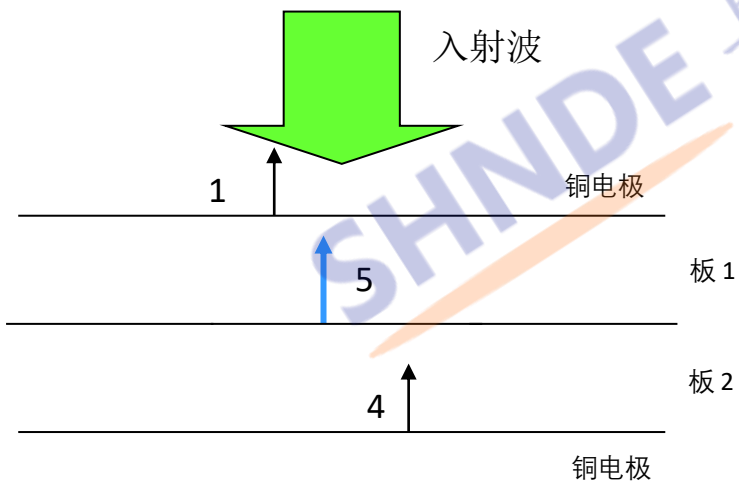
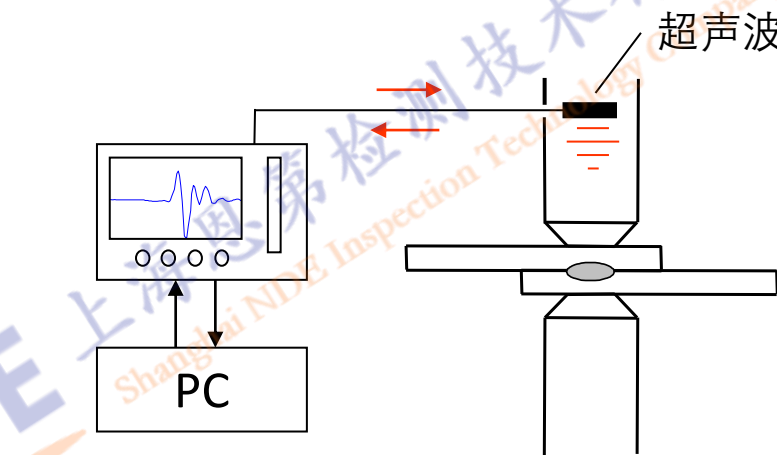


# 工作原理

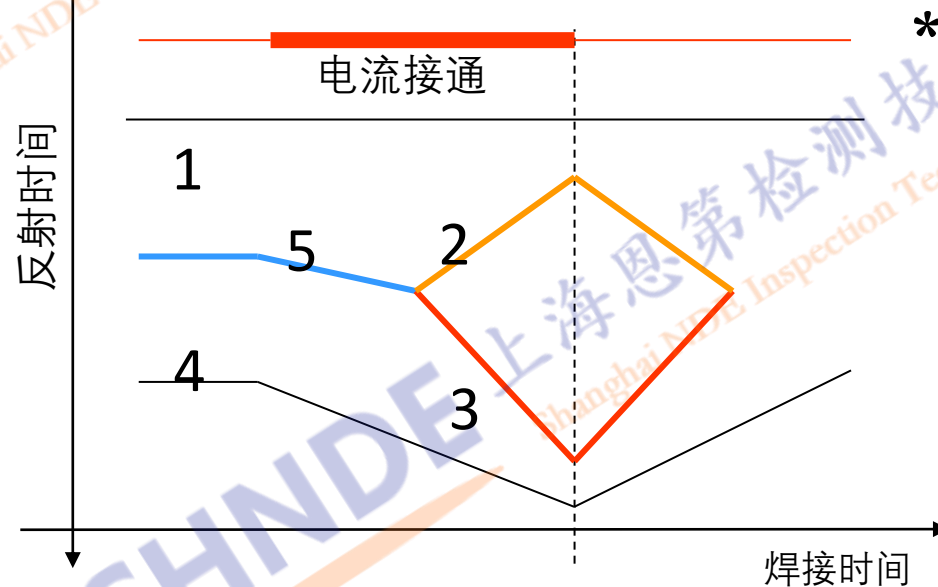
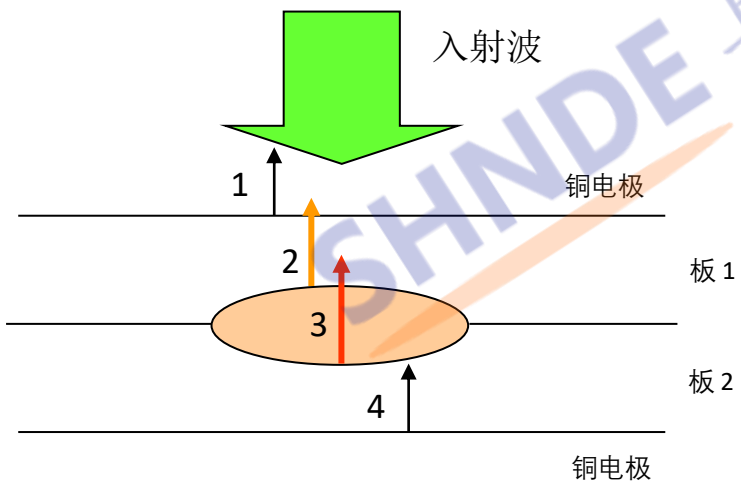
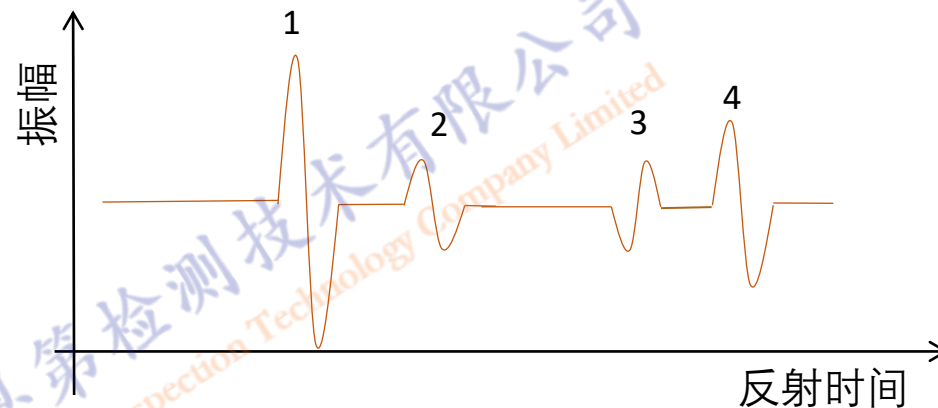
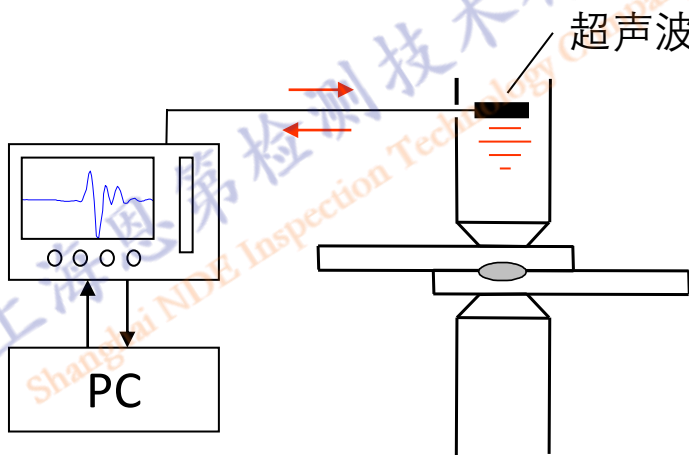


超声波特征图像可以直观显示熔核生成和凝固的过程

# 工作原理

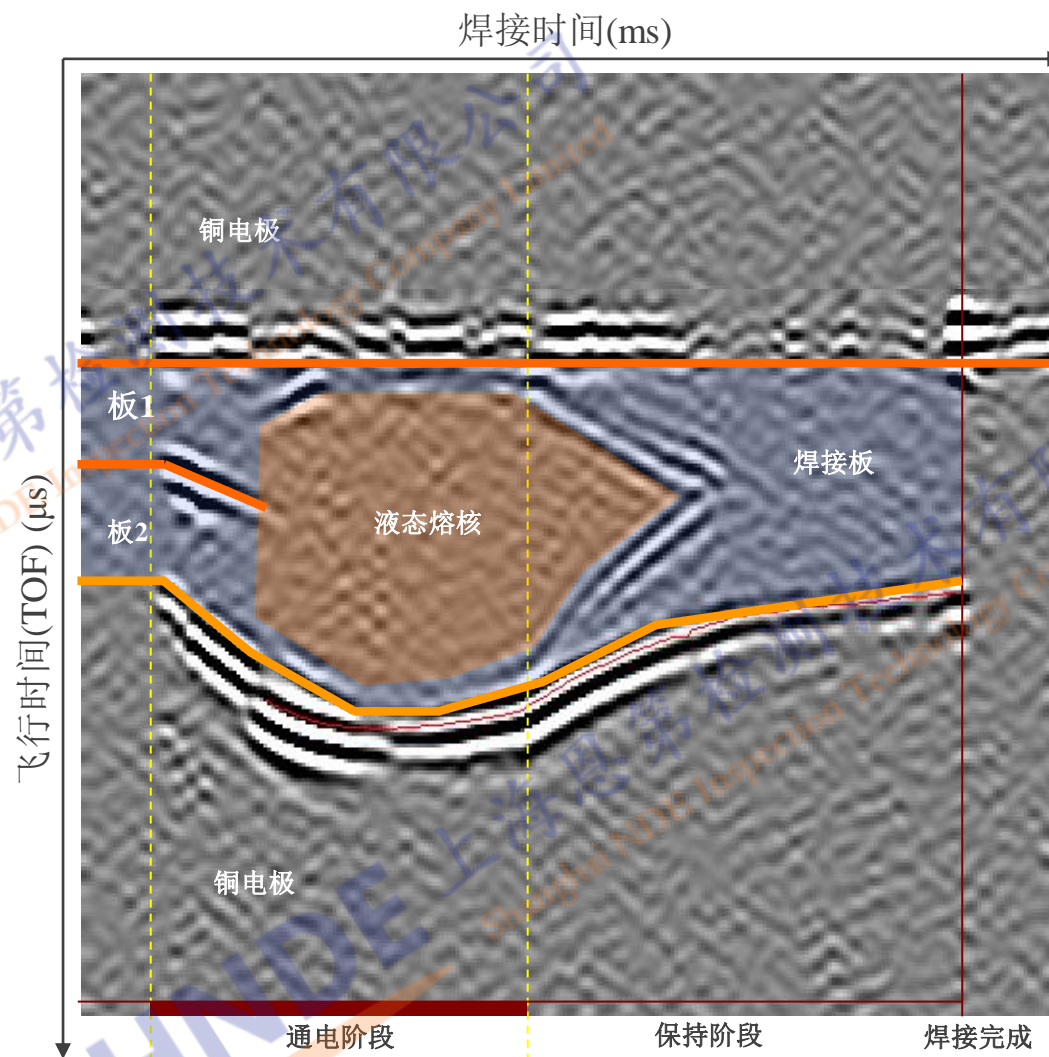
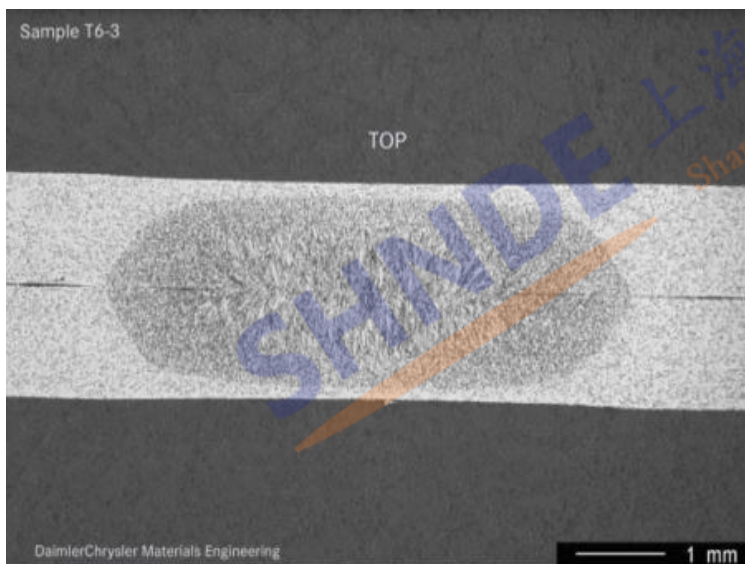


# 工作原理



# 超声波特征处理

先进的图像和信号处理算法可识别关键的焊接特征，包括熔核熔化阶段和凝固阶段





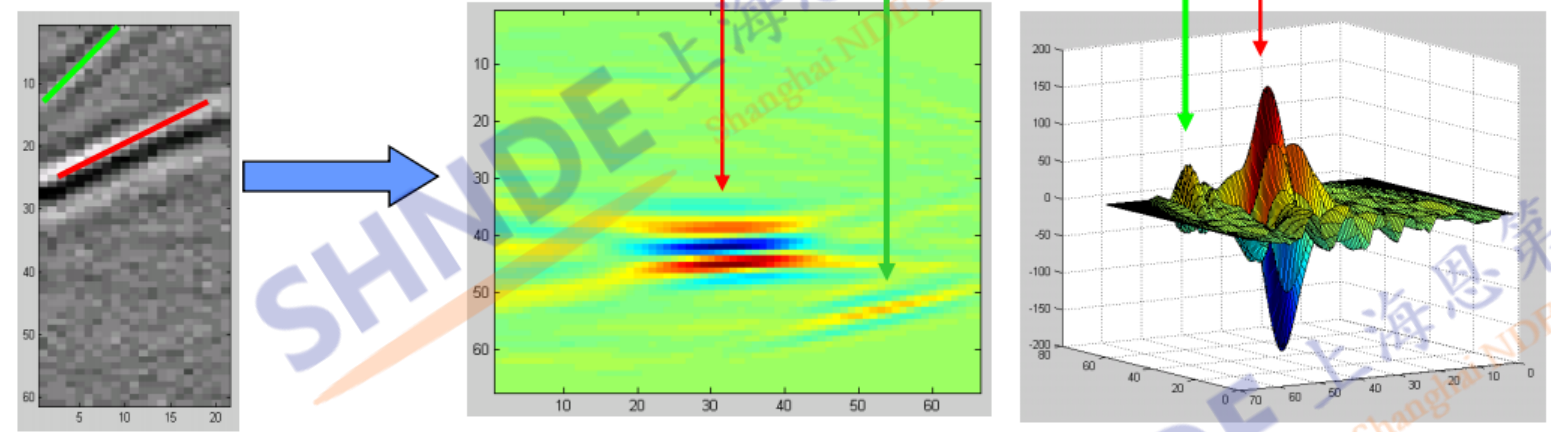
# 算法主要原理

## Hough变换

$$\rho = x \cdot \cos\theta + y \cdot \sin\theta$$

参数化图像转换成角度和距离的坐标系

Image(x, y)  $\longrightarrow$  Hough Space ( $\rho, \theta$ )



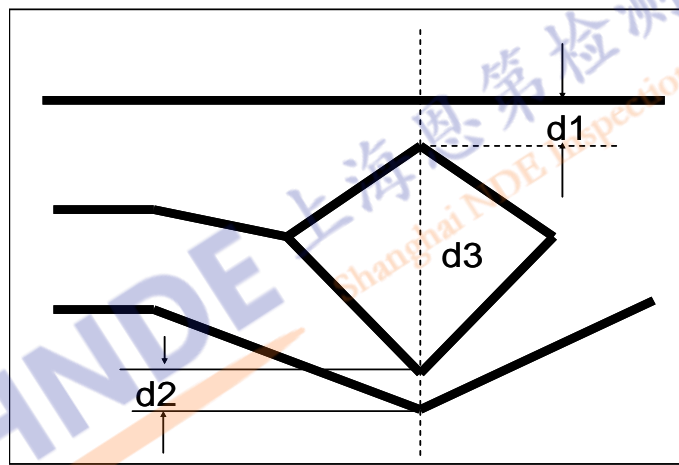
这一阶段处理的数据被用于更高级别的算法进行图像识别和解析

# 几何图像匹配

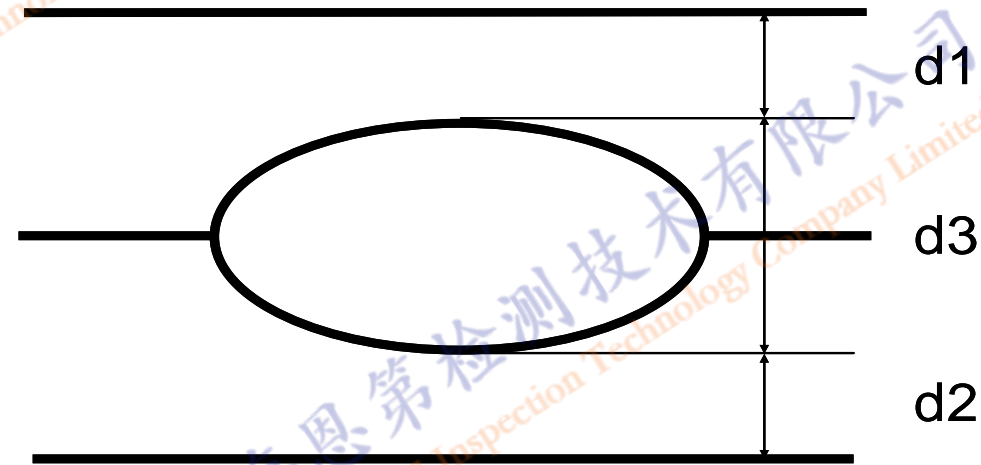
真实声学图像



模拟声学曲线



熔核几何图像



# 焊核质量评定参数

## TOF

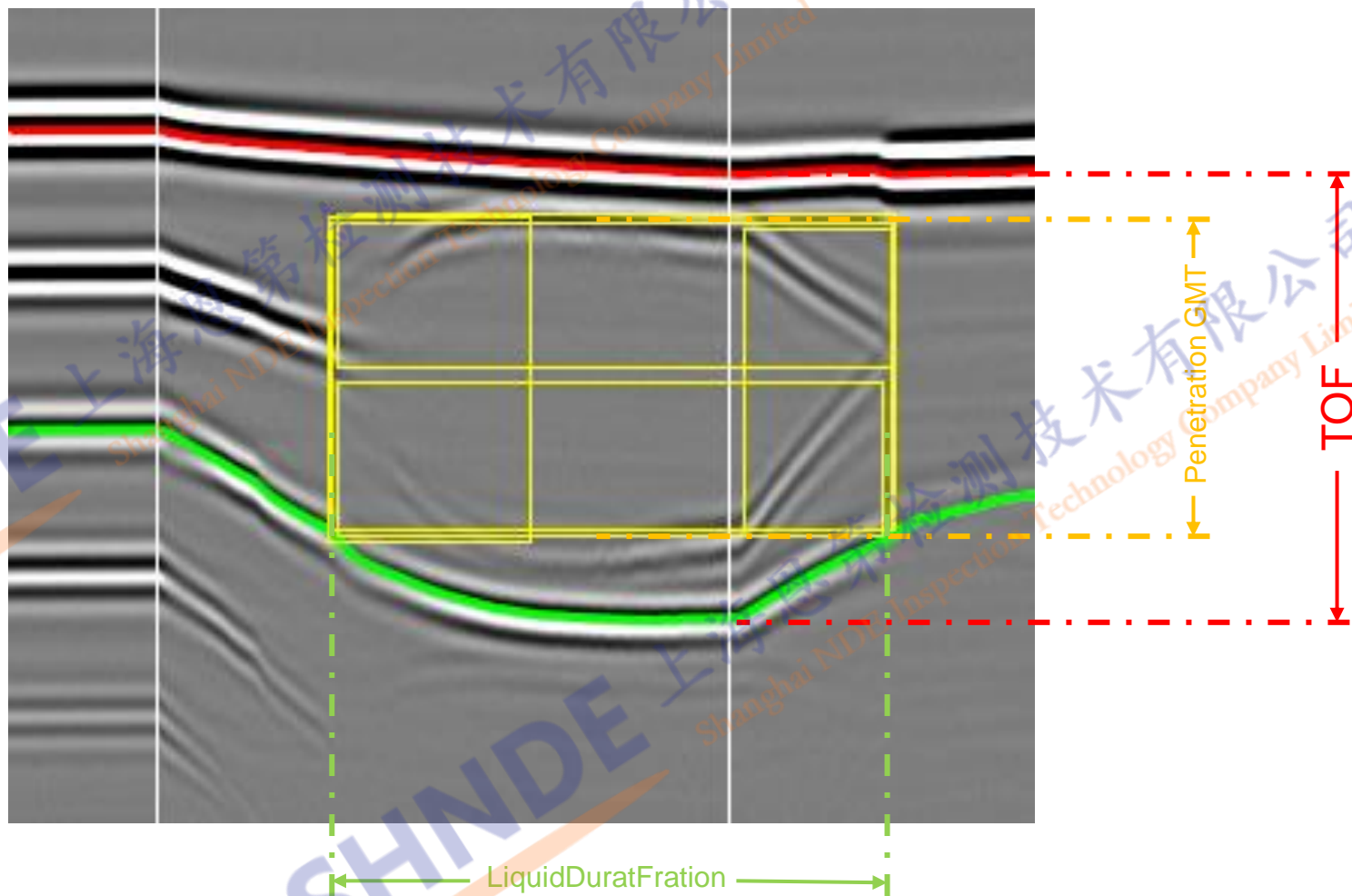
超声波底面反射时间

## Penetration GMT

液态熔池深度/板材厚度 \* 100%

## LiquidDuratFration

液态熔池存在时间/焊接时间 \* 100%



# 标定合格参数范围

## TOF Slope&TOF Intercept

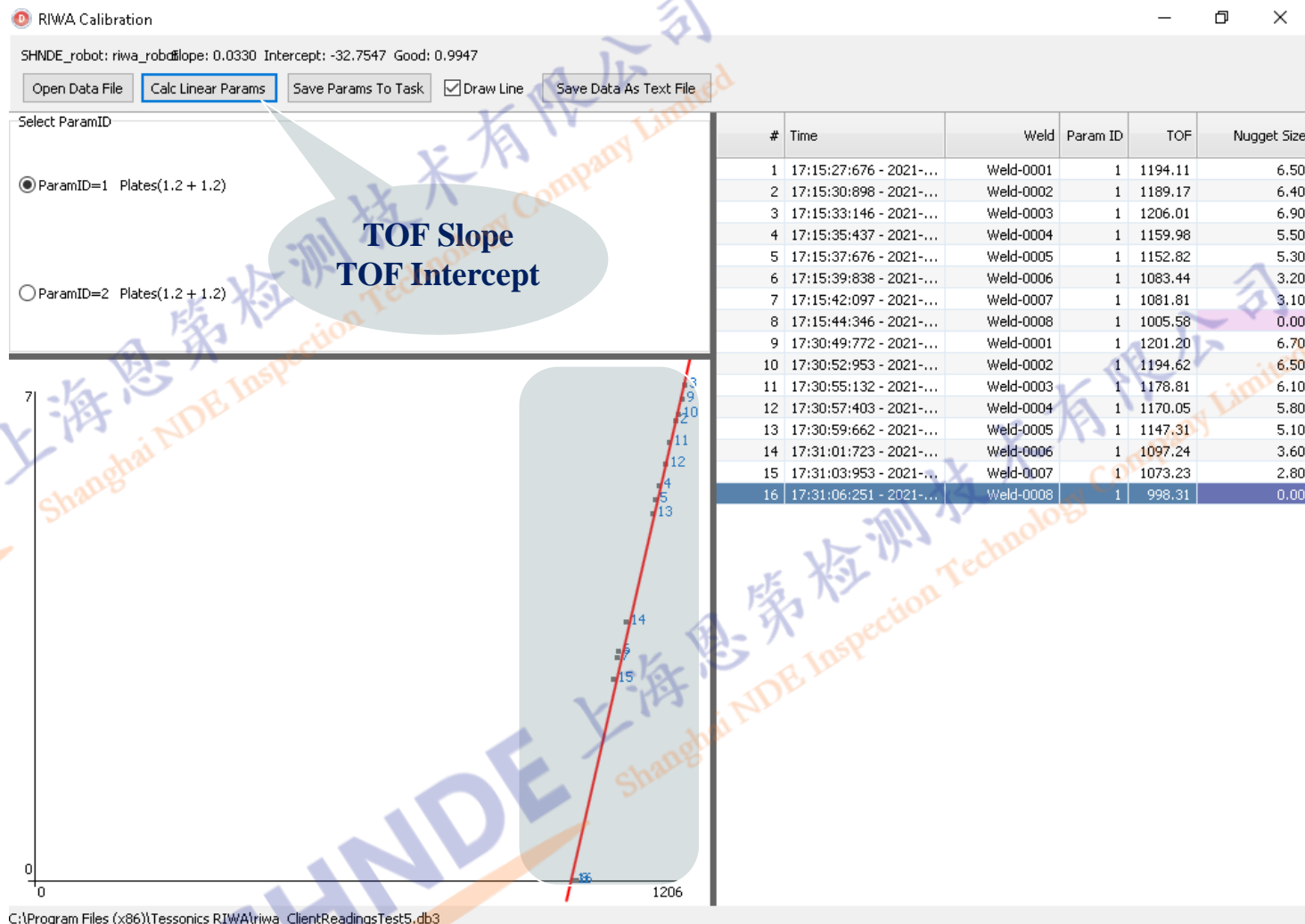
TOF值和熔核直径的线性关系

## LiqPenetrLim

(液态熔池深度/板材厚度 \* 100%)  
极限值

## LiqWTimeFractionLim

(液态熔池存在时间/焊接时间 \* 100%)  
极限值



# 客户端实时显示焊点检测结果

RIWA Monitor: Localnet

BACK B-Scan

riwa\_narmco  
RIWA-NARMCO-AL-W202

2019-12-20 16:04:20:192	Part-0001	✓	✓	✓	✓	✓	✓	✓	✓
2019-12-20 16:03:43:936	Part-0001	✓	✓	⚠	⚠	✓	✓	✓	✓
2019-12-20 16:03:06:388	Part-0001	✓	✓	✓	⚠	✓	✓	✓	✓
2019-12-20 16:02:30:196	Part-0001	✓	✓	✓	✓	✓	✓	✓	✓
2019-12-20 16:01:31:641	Part-0001	✓	✓	✓	✓	✓	✓	✓	✓
2019-12-20 16:00:55:291	Part-0001	✓	✓	✓	⚠	✓	✓	✓	✓
2019-12-20 16:00:17:900	Part-0001	✓	✓	✓	⚠	✓	✓	✓	✓
2019-12-20 15:59:41:823	Part-0001	✓	✓	⚠	⚠	✓	✓	✓	✓
2019-12-20 15:59:04:656	Part-0001	✓	✓	✓	⚠	✓	✓	✓	✓
2019-12-20 15:58:28:306	Part-0001	✓	✓	✓	⚠	✓	✓	✓	✓
2019-12-20 15:57:51:140	Part-0001	✓	✓	✓	⚠	✓	✓	✓	✓
2019-12-20 15:57:15:975	Part-0001	✓	✓	✓	✓	✓	✓	✓	✓
2019-12-20 15:56:30:171	Part-0001	✓	✓	✓	⚠	⚠	✓	✓	✓
2019-12-20 15:55:53:917	Part-0001	✓	✓	✓	✓	⚠	✓	✓	✓
2019-12-20 15:55:09:936	Part-0001	✓	✓	✓	✓	✓	✓	✓	✓
2019-12-20 15:54:33:826	Part-0001	✓	✓	✓	✓	✓	✓	✓	✓
2019-12-20 15:53:53:891	Part-0001	✓	✓	✓	✓	✓	✓	✓	✓
2019-12-20 15:53:17:639	Part-0001	✓	✓	✓	✓	✓	✓	✓	✓
2019-12-20 15:52:40:376	Part-0001	✓	✓	✓	✓	✓	✓	✓	✓
2019-12-20 15:52:04:108	Part-0001	✓	✓	✓	✓	✓	✓	✓	✓
2019-12-20 15:51:26:910	Part-0001	✓	✓	✓	✓	✓	✓	✓	✓
2019-12-20 15:50:50:623	Part-0001	✓	✓	✓	✓	✓	✓	✓	✓
2019-12-20 15:50:13:410	Part-0001	✓	✓	✓	✓	✓	✓	✓	⚠
2019-12-20 15:49:37:141	Part-0001	✓	✓	✓	✓	✓	✓	✓	✓
2019-12-20 15:48:59:670	Part-0001	✓	✓	✓	✓	✓	✓	✓	✓
2019-12-20 15:48:23:210	Part-0001	✓	✓	✓	✓	✓	✓	✓	✓

[Weld-25 : Good(3) : Good(0.9655)]

BScan Parameters

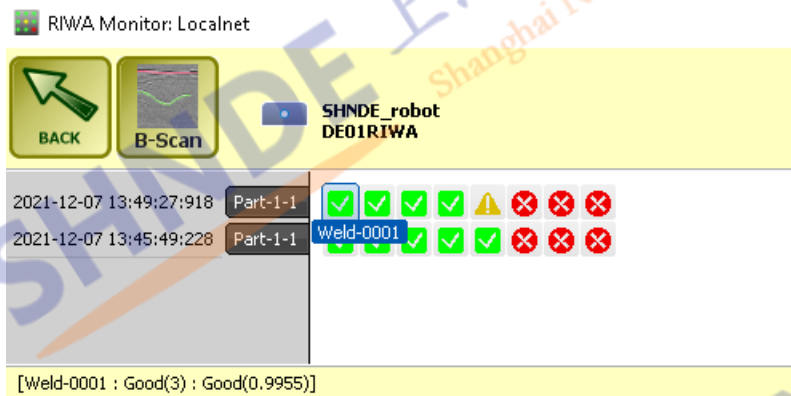
Pos (0:0) Amp: 0.15%

20.81 21.81 22.81 t=1/2s

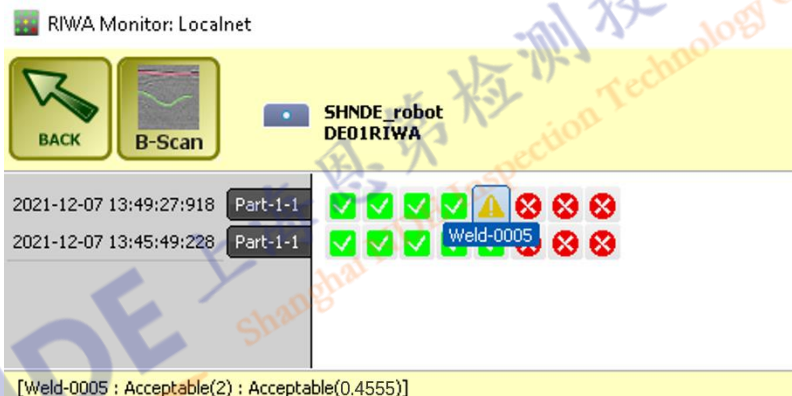
# 焊点检测结果的显示方式

等级	符号	注释
bad		不良焊点
acceptable		可接受（临界焊点）
good		合格焊点
good		合格但存在过度焊接
uncertain		焊接质量无法确认（超声波信号异常）
Error		系统出错（未检测到焊接电流）
unknown		无法识别（未知错误）

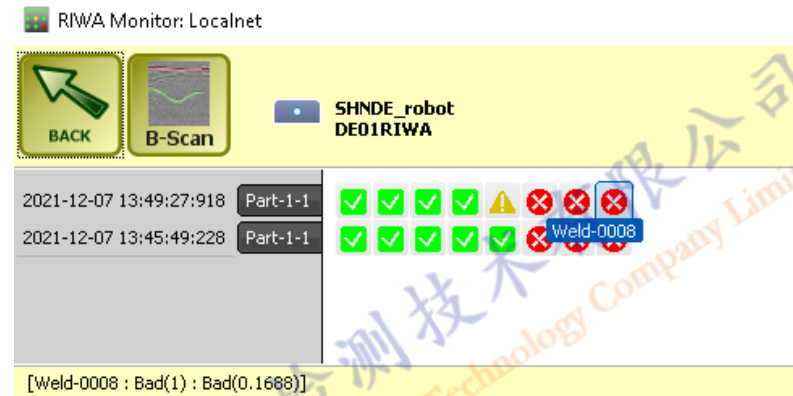
# 检测结果显示实例



合格焊点  
评分: **0.9955**



临界焊点  
评分: **0.4555**



不良焊点  
评分: **0.1688**

## 检测报告导出

RIWA Measurements 2021-12-09 18:54:11:986

## RIWA Measurements

Time	Weld	Quality
2021-12-07 13:49:42:217	Weld-0008	Bad (0.1688)
2021-12-07 13:49:40:177	Weld-0007	Bad (0.1788)
2021-12-07 13:49:38:166	Weld-0006	Bad (0.2488)
2021-12-07 13:49:36:257	Weld-0005	Acceptable (0.5555)
2021-12-07 13:49:34:337	Weld-0004	Good (0.7655)
2021-12-07 13:49:32:337	Weld-0003	Good (0.7755)
2021-12-07 13:49:30:408	Weld-0002	Good (0.9355)
2021-12-07 13:49:27:918	Part-1 - Weld-0001	Good (0.9955)
2021-12-07 13:46:03:488	Weld-0008	Bad (0.0088)
2021-12-07 13:46:01:468	Weld-0007	Bad (0.2688)
2021-12-07 13:45:59:508	Weld-0006	Bad (0.3488)
2021-12-07 13:45:57:637	Weld-0005	Good (0.5655)
2021-12-07 13:45:55:686	Weld-0004	Good (0.7155)
2021-12-07 13:45:53:659	Weld-0003	Good (0.8655)
2021-12-07 13:45:51:678	Weld-0002	Good (0.9755)
2021-12-07 13:45:49:228	Part-1 - Weld-0001	Good (0.9955)

PDF格式检测报告

(便于离线查看)

	A	B	C	D
1	robot	time	weld	quality
2	riwa_robot	2021-12-07 13:45:49:228	Part-1 - Weld-0001	Good (0.9955)
3	riwa_robot	2021-12-07 13:45:51:678	Weld-0002	Good (0.9755)
4	riwa_robot	2021-12-07 13:45:53:659	Weld-0003	Good (0.8655)
5	riwa_robot	2021-12-07 13:45:55:686	Weld-0004	Good (0.7155)
6	riwa_robot	2021-12-07 13:45:57:637	Weld-0005	Good (0.5655)
7	riwa_robot	2021-12-07 13:45:59:508	Weld-0006	Bad (0.3488)
8	riwa_robot	2021-12-07 13:46:01:468	Weld-0007	Bad (0.2688)
9	riwa_robot	2021-12-07 13:46:03:488	Weld-0008	Bad (0.0088)
10	riwa_robot	2021-12-07 13:49:27:918	Part-1 - Weld-0001	Good (0.9955)
11	riwa_robot	2021-12-07 13:49:30:408	Weld-0002	Good (0.9355)
12	riwa_robot	2021-12-07 13:49:32:337	Weld-0003	Good (0.7755)
13	riwa_robot	2021-12-07 13:49:34:337	Weld-0004	Good (0.7655)
14	riwa_robot	2021-12-07 13:49:36:257	Weld-0005	Acceptable (0.5555)
15	riwa_robot	2021-12-07 13:49:38:166	Weld-0006	Bad (0.2488)
16	riwa_robot	2021-12-07 13:49:40:177	Weld-0007	Bad (0.1788)
17	riwa_robot	2021-12-07 13:49:42:217	Weld-0008	Bad (0.1688)

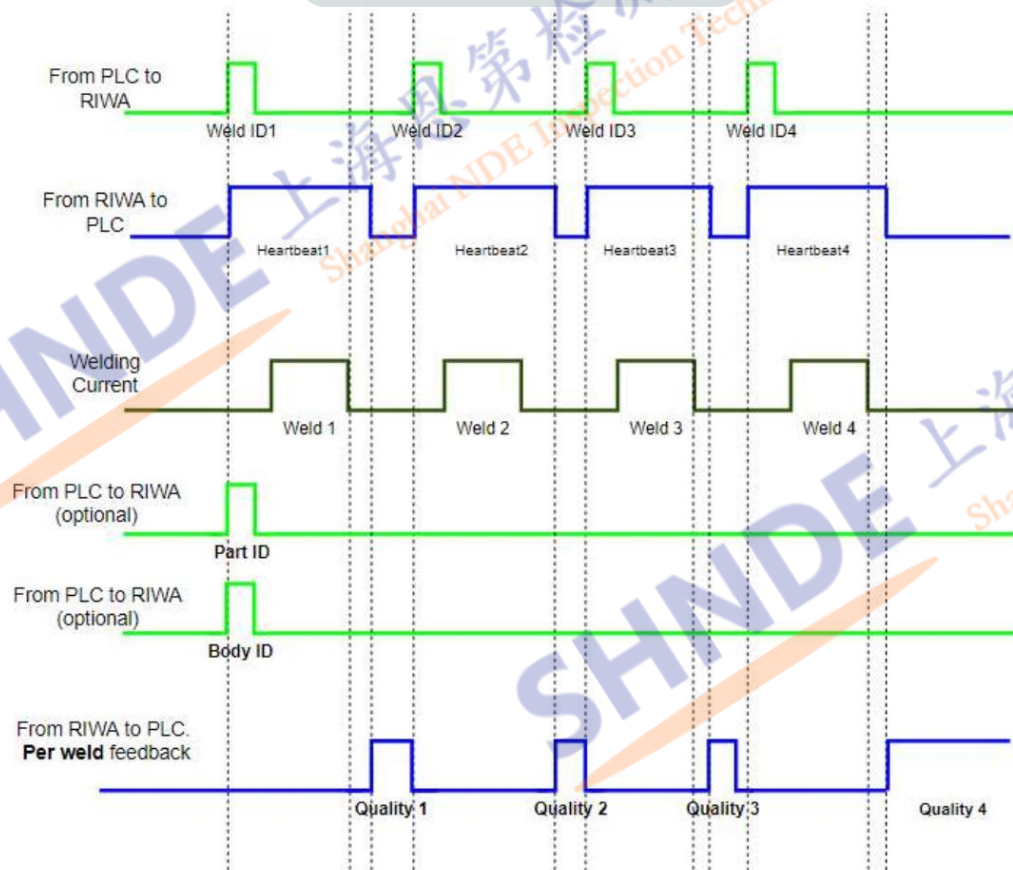
CSV格式检测报告

(便于数据上传)



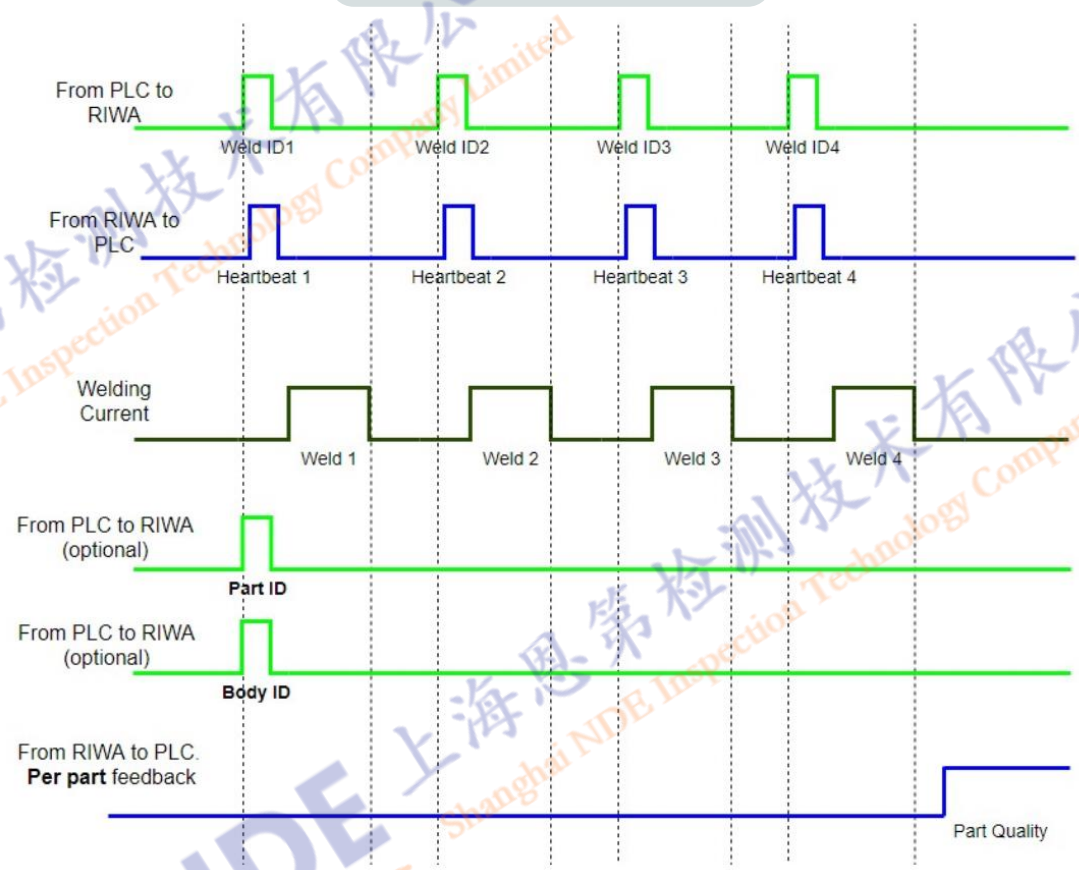
# 检测结果实时输出到PLC

## 单点反馈模式



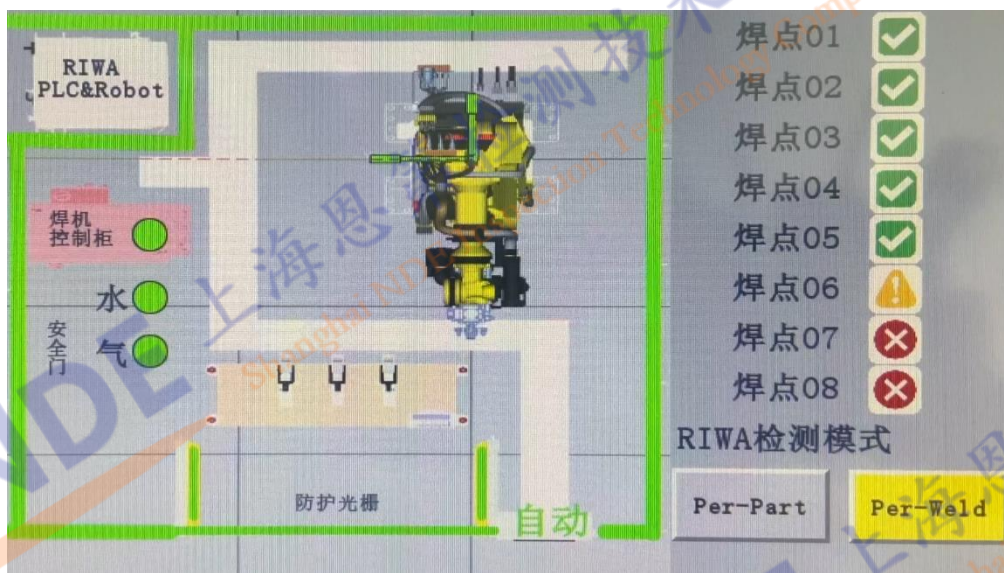
每个焊点焊接完成后，**RIWA**将该焊点质量评分实时发送到**PLC**

## 零件反馈模式

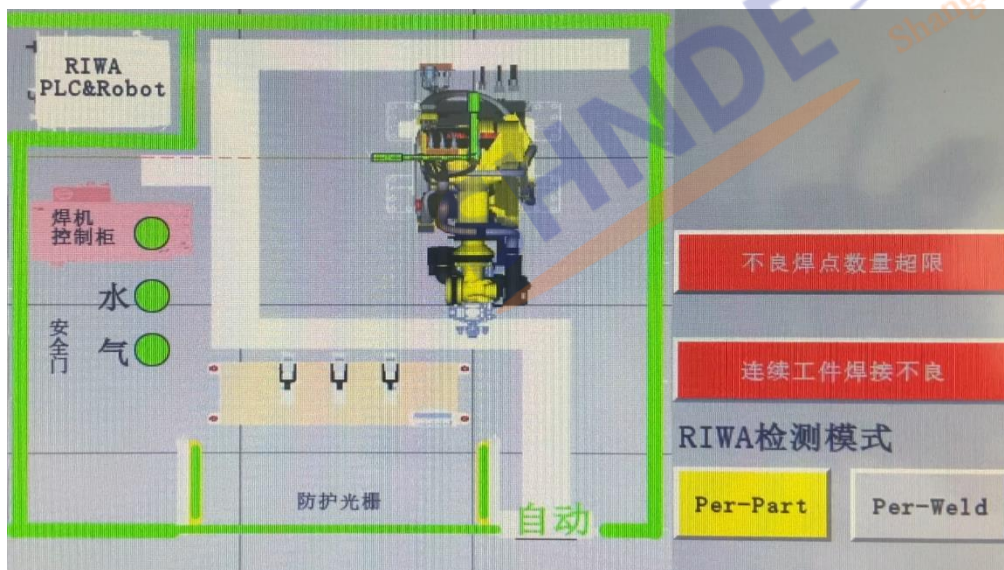


提前设置允许出现不良焊点的频率，每个零件焊接完成后，**RIWA**判断该零件是否符合预设要求，将结果发送到**PLC**

# PLC实时输出检测结果



每个焊点焊接完成后，PLC实时输出此焊点的检测结果

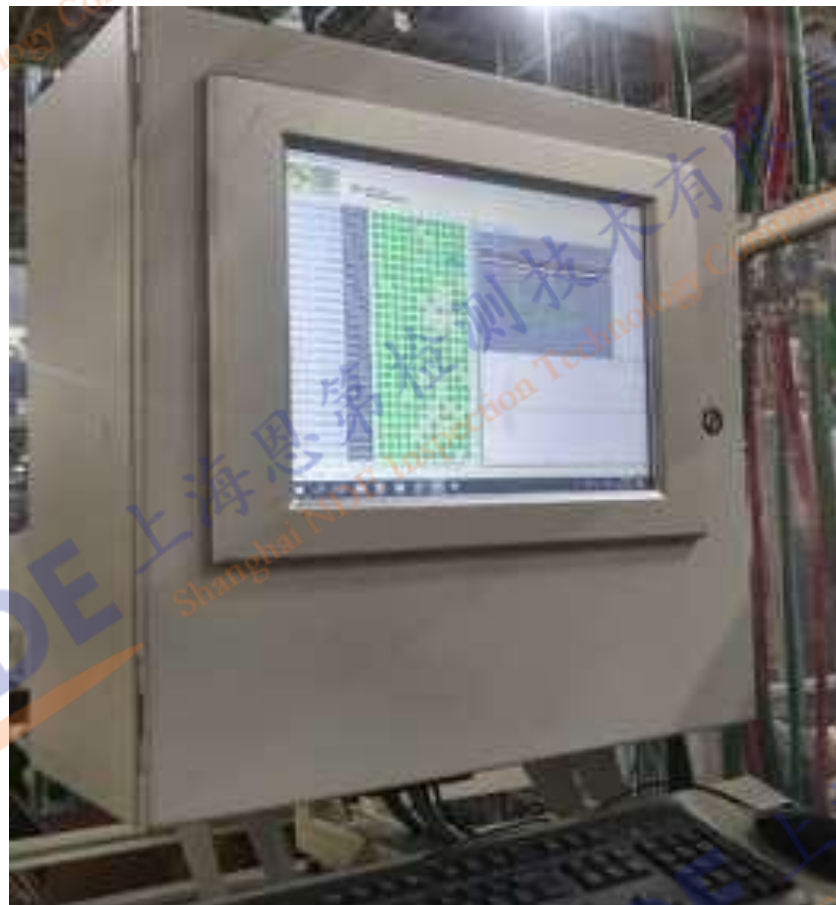


每个零件焊接完成后，PLC输出此零件不良焊点数量是否超过预设限制；或是否出现连续多个零件同一位置焊点焊接不良

# 基本配置



通信模块



RIWA主机系统机柜



电流传感器

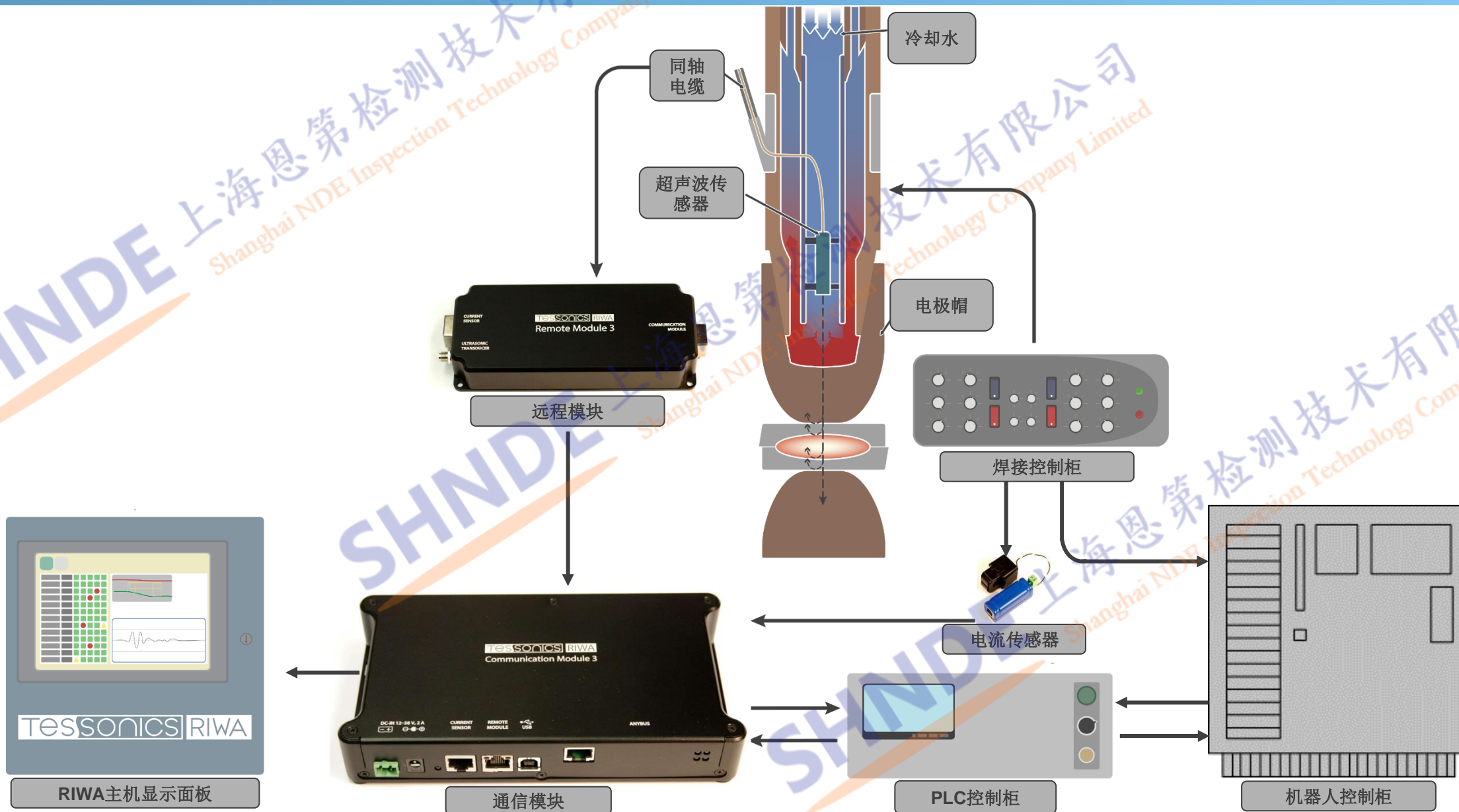


远程模块



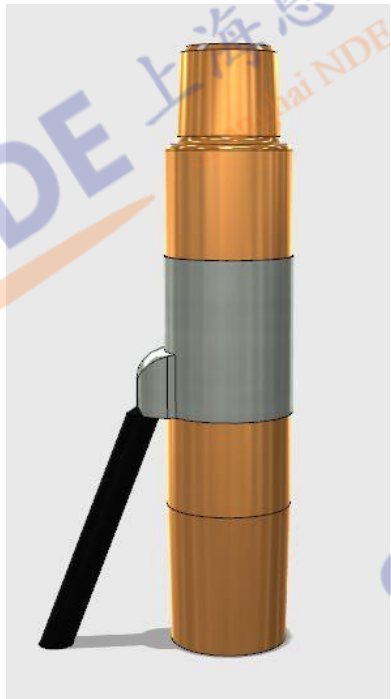
电极内置传感器

# 系统连接方式

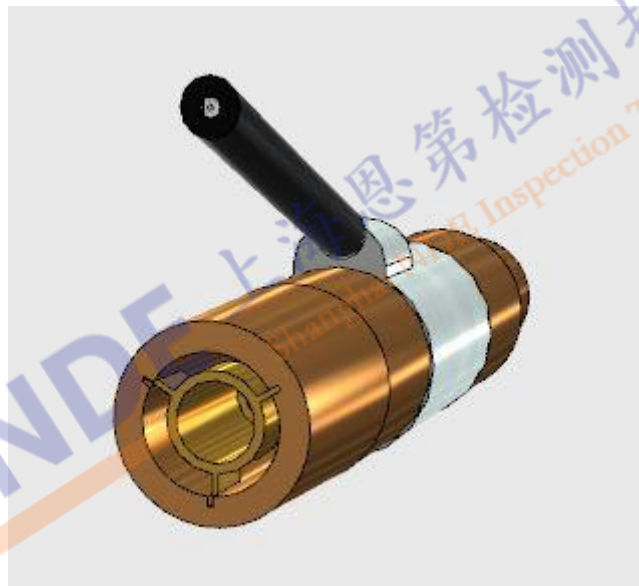


# 电极改造及传感器安装

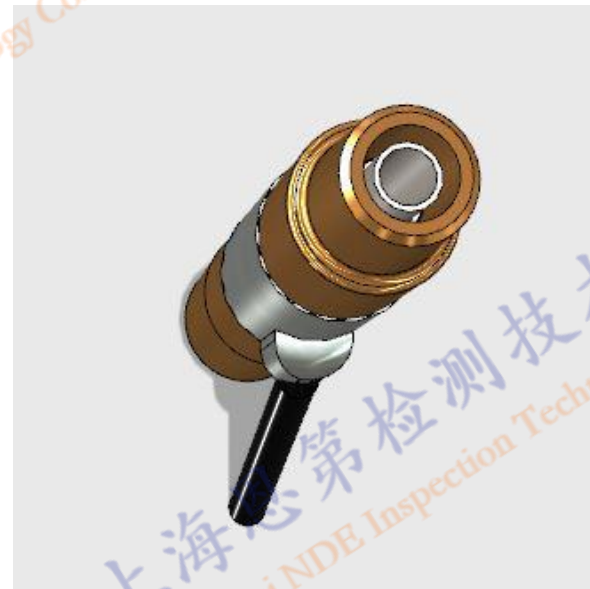
电机外部使用柔性  
同轴电缆连接



冷却水从中央通道进  
入，从外部通道返回



对电极帽更换不会  
产生影响



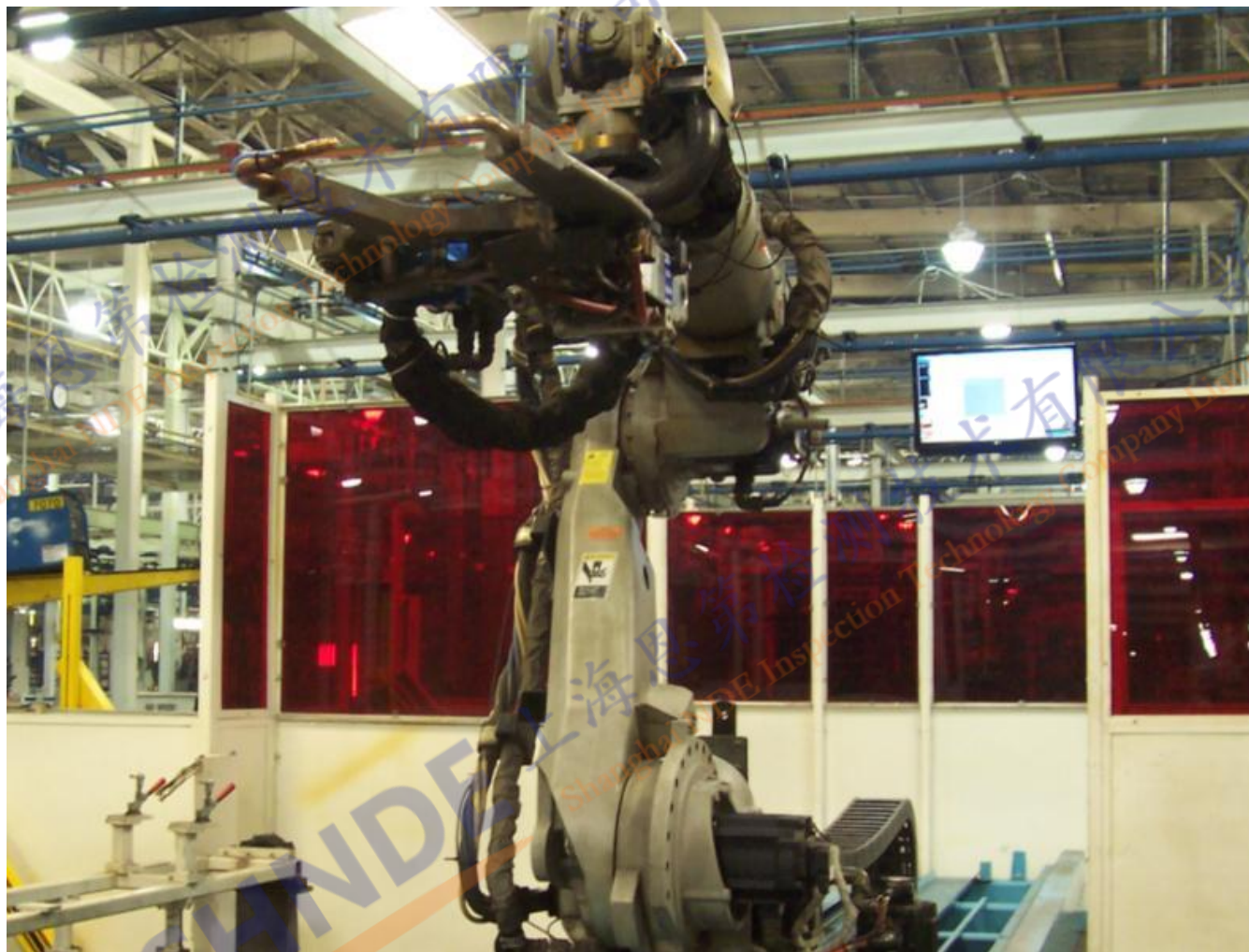
需保持适当的水流量以冷却电极帽

# 检测应用范围

- 被测工件单层板厚：**0.65 - 2.50毫米**
- 堆栈类型：**两层板、厚度相近的三层板**
- 材质：**低碳钢、高强度钢、双相超高强度钢、铝**
- 表面处理：**无镀层及镀锌板均可检测**
- 通信接口：**包括但不限于DeviceNet; Interbus; Discrete I/O; Profinet**
- 电极角度：**电极与板材切面角度为 $90 \pm 2$ 度**

# 应用案例

凯斯纽荷兰装配厂  
内布拉斯加州，美国



# 应用案例

梅赛德斯-奔驰  
圣保罗，巴西

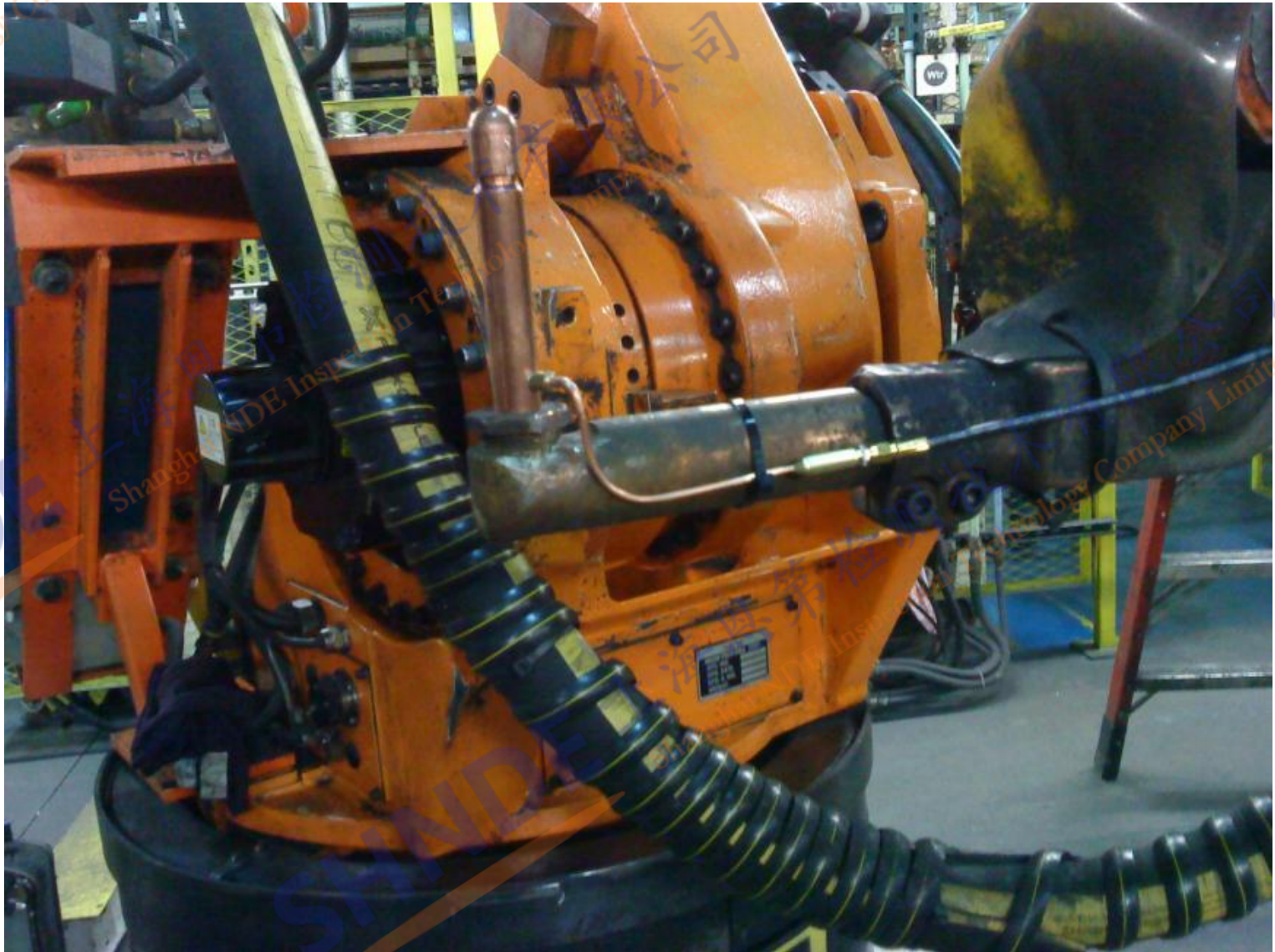




# 应用案例

SHNDE 上海恩第检测技术有限公司  
Shanghai NDE Inspection Technology Company Limited

克莱斯勒  
温莎装配厂，加拿大



SHNDE

SHNDE 上海恩第检测技术有限公司  
Shanghai NDE Inspection Technology Company Limited

SHNDE

SHNDE 上海恩第检测技术有限公司  
Shanghai NDE Inspection Technology Company Limited

# 应用案例

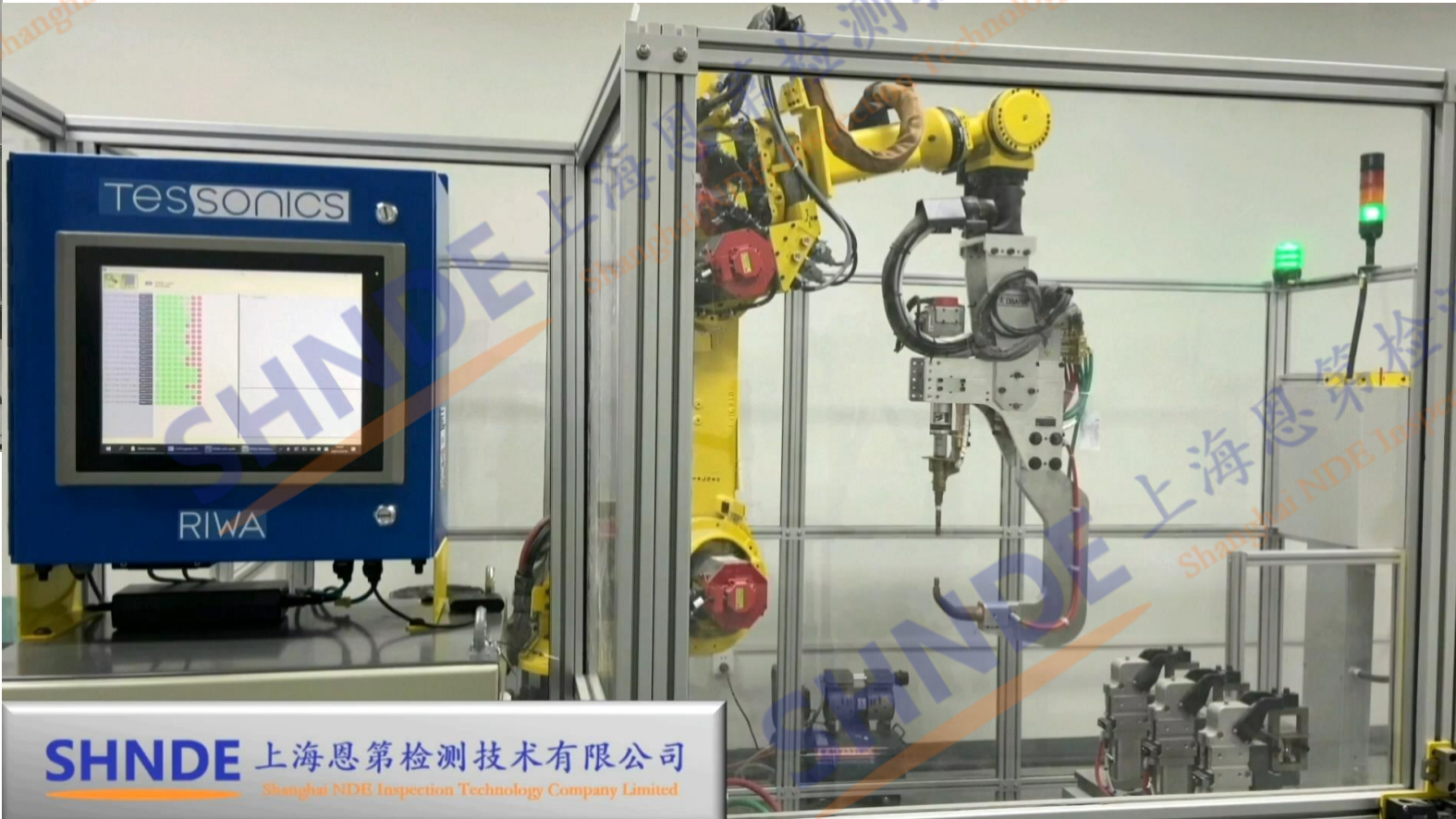
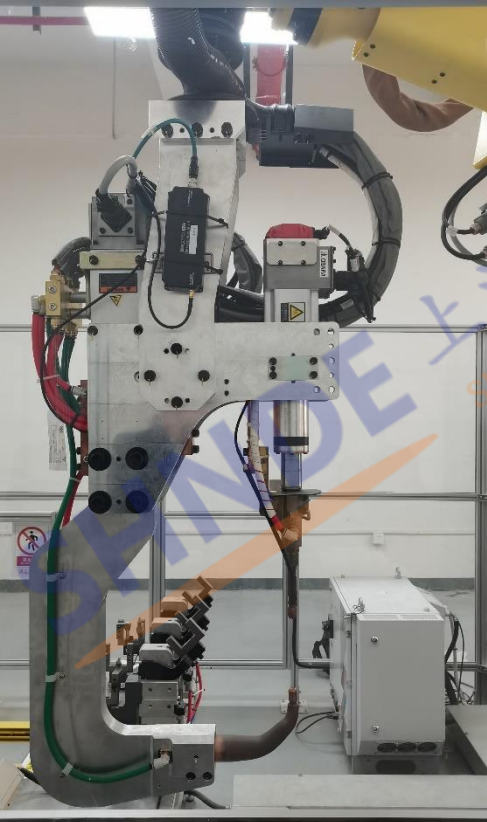


日本某工厂



# 应用案例

上海恩第，中国



# RIWA系统部分车企合作伙伴

- Toyota Canada (Woodstock and Cambridge)
- Toyota US (Indiana and Kentucky)
- Ford US (Dearborn)
- Ford (Cologne, Germany)
- Narmco (Alabama)
- Multimatic (Indiana)
- Nami (Moscow)
- Martur (Romania)
- Narmco (Windsor, ON, Canada)
- Tiberina (Italy)
- .....

# RIWA演示系统全球分布地区

- Tessonics Germany
- Tessonics Headquarters (Windsor, Canada)
- Obara Korea
- Welding Science (Sao Paulo, Brazil)
- Shanghai NDE (Shanghai, China)

如需进一步了解产品信息，欢迎联络

加拿大TESSONICS公司大中华区唯一授权代理商

**SHNDE** 上海恩第检测技术有限公司

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